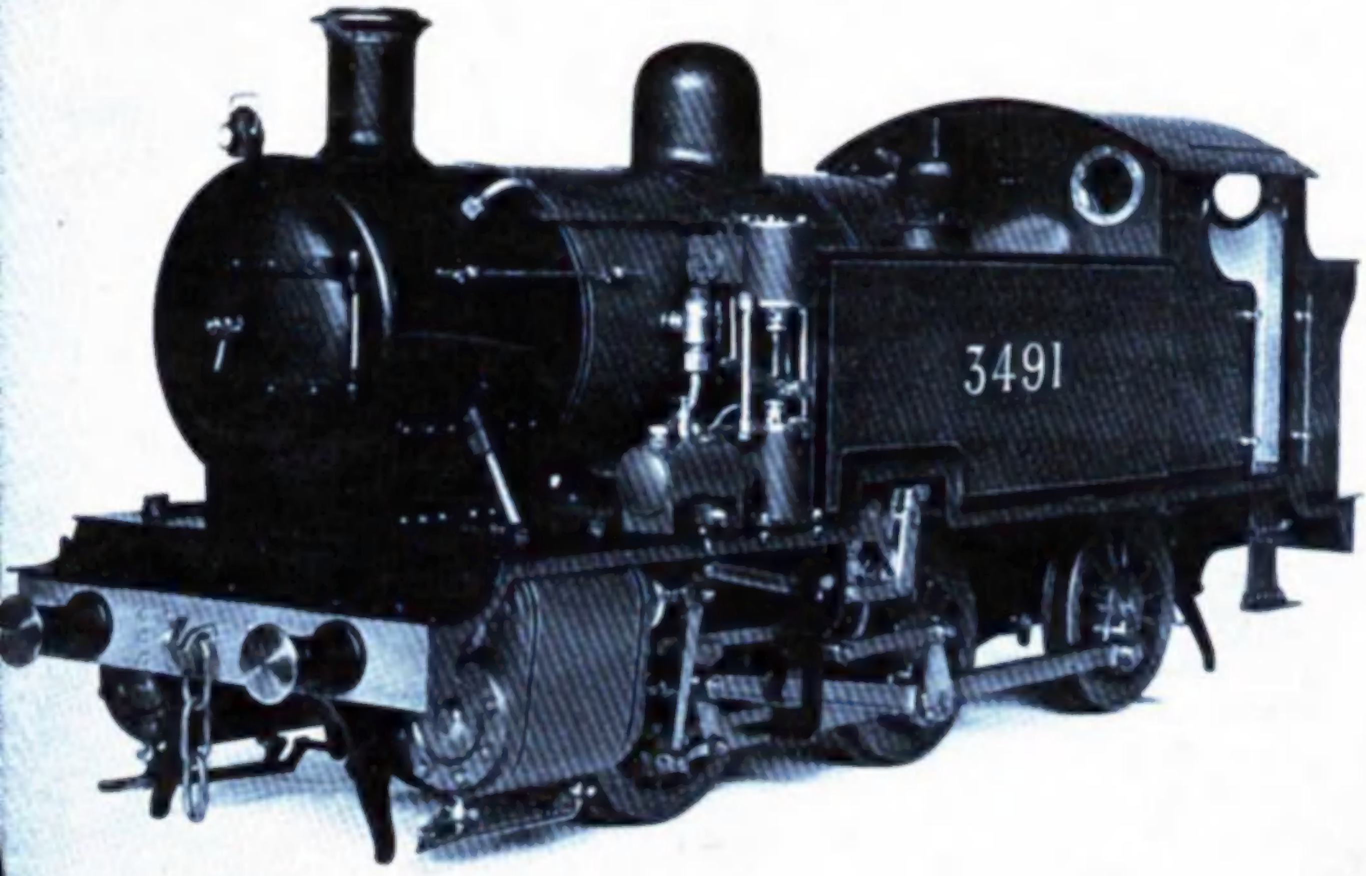
THE MODEL ENGINEER



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THE
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Our Cover Picture

A very nice example of "L.B.S.C.'s" *P.V. Baker* adorns our cover this week; she was built by Mr. L. A. Burville, of Eastbourne, and photographed by Mr. H. C. Deal of the same place. The engine, as most readers will know, is a $3\frac{1}{2}$-in. gauge 0-6-0 tank engine of pleasing proportions and is fitted with piston-valves operated by Baker valve-gear. Mr. Burville has equipped her with a very neat little donkey pump; but for further information on this particular feature we refer readers to page 789 where another photograph will be found, together with some comments by Mr. Burville himself. We will content ourselves by remarking that the photographs reveal very neat workmanship and excellent finish.

SMOKE RINGS

Simplest Not Always Best

A VISITOR came to our office the other day to discuss the question of building a simple $3\frac{1}{2}$-in. gauge locomotive. He was insistent that it should be *simple*, pleading that he had very little in the way of workshop equipment and was certainly never likely to possess the apparatus required for brazing the components of a boiler together. We were interested in the preliminary drawings he had made; they showed that the frames, wheels, cylinders and motion (slip-eccentric) were to be the same as those for *Juliet*, but the proposed boiler was what was described as a "simplified version" of the original. It was certainly *that*—on paper! The barrel and firebox were all right, but to "save a lot of silver-soldering," our friend proposed to omit the superheater and to provide only four $\frac{3}{4}$-in. tubes "instead of all those fiddly little tubes that are shown on your blueprints," as he put it.

Up to this point, we had listened calmly to our friend's proposals; but we now took him firmly, though, we hope, kindly in hand! We agreed that he had certainly simplified the engine, but we pointed out that he had done it by sacrificing the whole of the boiler power! We added that there was very little difference between the silver-soldering of sixteen $\frac{3}{8}$-in. tubes plus four $\frac{3}{4}$-in. ones and that of doing the same thing to only four $\frac{3}{4}$-in. tubes. The number of tubes was really immaterial, so far as the silver-soldering is concerned; we thought our friend would fare much better if he used the full specified number and sizes of tubes, silver-soldering them in two goes. It would take more time, but the result would be a boiler that would steam!

We sometimes have to deal with readers' ideas of simplifying work, and in nearly every case they show that the simplifier has failed to look far enough ahead and to think out the results of his "simplifications." In the case referred to above, our friend departed a wiser, but, we hope, not a sadder man, though he seemed surprised when we warned him that it is very easy to run into trouble through over-simplifying the parts of a locomotive.

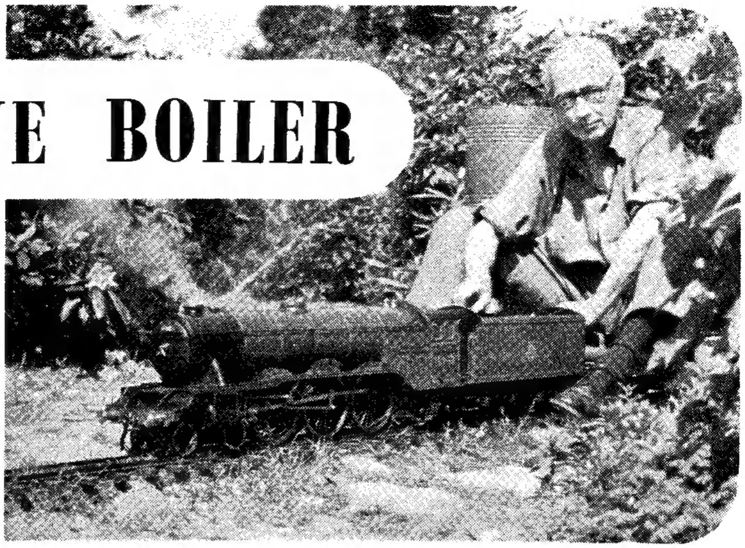
Schoolboy Enthusiasts

RECENTLY WE had the pleasure of being invited to visit an interesting little exhibition arranged by the members of the Smee Society at St. Paul's School. The society was founded more than fifty years ago to encourage the boys to take up craftsmanship in a practical way, and a prize is given annually for the best piece of work.

At the present time, model railways seem to have the most attraction for these youthful craftsmen; but we were very interested to find two miniature electric trains running on $1\frac{1}{4}$-in. gauge track. Both these models were built by the same lad, and were excellent little reproductions of their prototypes; one was equipped for overhead current collection, and was fitted with its proper "flexible pole" collector made very nicely to scale, except that the pulley was a circular skid to ensure, in so small a scale, proper electrical contact with the overhead conductor. The other car was arranged to pick up current from a third rail laid between the running rails of the track.

Railway models of more usual type were to be seen, some for "OO"-gauge were running on a suitable length of track. We were also taken to the top floor of the school buildings to see the radio room, where the boys are instructed in assembling and wiring radio components. We were shown the site for a proposed "OO"-gauge railway, in a nearby room, while out in the grounds, on a site behind the school workshops, "civil engineering" work is in progress in preparation for a fairly extensive outdoor "O"-gauge railway. We much enjoyed our visit which, to us, was both interesting and encouraging.

A 1-in. Scale
LOCOMOTIVE BOILER



(1). *The ¾-in. scale "Gresley" Pacific on the continuous track at Ringwood, Hants.*

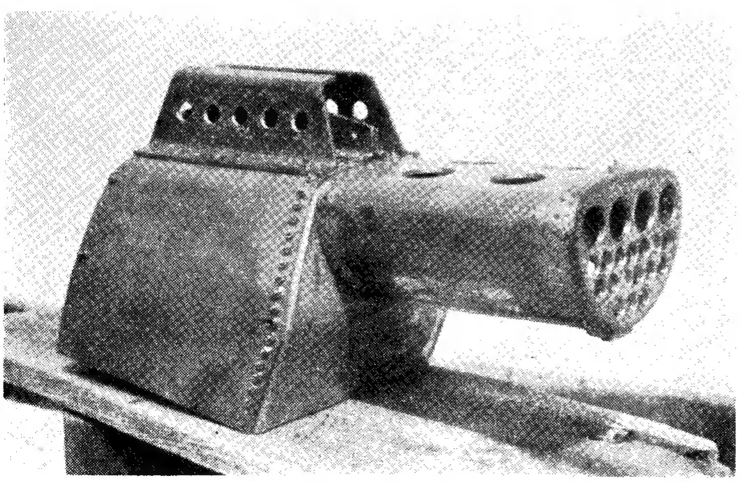
By James Perrier

SINCE completing the ¾-in. scale "Gresley" Pacific, (see THE MODEL ENGINEER, February 12th, 1953) and also the 3½-in. gauge continuous track for running on, see Photograph 1, a start was made over three years ago on a 1-in. scale South African Railways, Type 15F, 4-8-2 locomotive, so that the larger scale could still be used on the 3½-in. gauge track, the S.A.R. gauge being only 3 ft. 6 in.

These notes about the boiler are written as a warning to the enthusiastic model engineers who embark on a 1-in. scale model, as the boiler work in this scale has been found to be nearly beyond the physical capacity of one pair of hands, and although dogged perseverance brought this one to completion, it was not without the wish that there were some extra model engineers or young lads handy to give a helping hand, especially when trying to drill stay holes on the backplate, with a boiler 2 ft. 8 in. long upstanding nearly vertically and over 70 lb. in weight !

Design

The design for a boiler in which the boiler-tube was just "laid on" the throatplate, and brazed to it, also the combustion chamber on throatplate; this was considered impractical, considering the weight and heat losses, so patterns were made for both throatplate and firebox-combustion chamber throatplate in which proper flanges were cast in each direction, so that all parts could be close-rivetted and mechanically sound *before* brazing. A pattern was also made for the firehole opening, which is 1½ in. × 1⅝ in. to allow this also to be close-riveted all round. The castings were cast locally in gunmetal, and although only $\frac{3}{16}$ in. thick, were carefully scraped and cleaned up and examined for flaws, etc.; but all went well, and they successfully withstood the water test to 160 lb. per sq. in.



(2). *The firebox and combustion chamber temporarily bolted together before riveting, for the 1-in. scale 4-8-2 South African Railways locomotive*

Boiler Tube

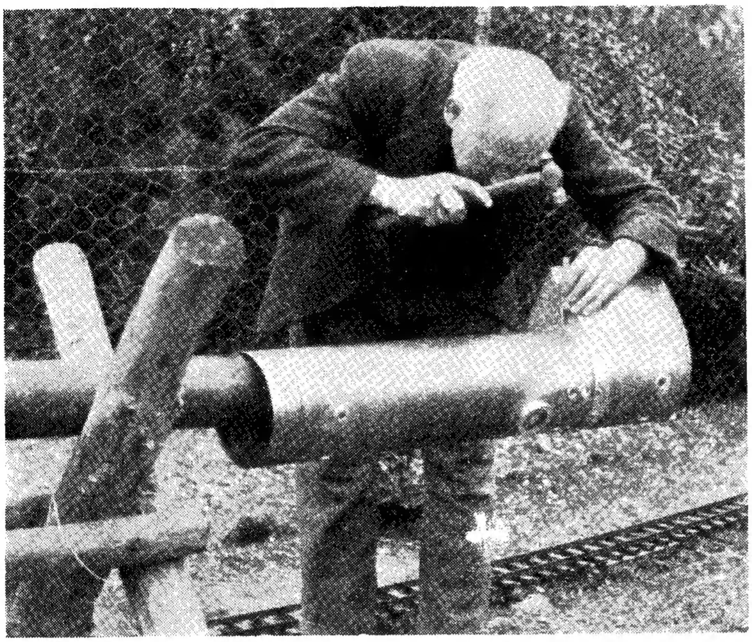
This was a piece of 6½ in. o.d. × 10-s.w.g. × 22½ in. long solid-drawn copper, which weighed 18 lb., and all other wrappers, inside and outside also tube and backplate were of 10-s.w.g. (0.128 in. thick). The outside wrapper was first riveted to the throatplate casting and then riveted to the boiler tube; see Photograph 2. The bottom or outside of the firebox being over 9 in. wide × 8¾ in. long.

Firebox

The combustion chamber projects 7 in. into the boiler-tube, and is also close-riveted to firebox throatplate, as are the inner firebox wrapper and firehole backplate thereto, see Photograph 3. Four 1¼ in. o.d. × 16-s.w.g. crosswater tubes are provided in the combustion chamber, and the centre stay and side stays were riveted to the firebox crown.

Backplate

This is of 10-s.w.g.; a pattern was made for cast-iron former for flanging (as was done with all parts that had to be flanged) and as it was impossible to close-rivet this to the firebox wrapper, being the last part to be assembled, some sixty 4-B.A. round-head screws were made in



(3). *The throat plate (casting) being riveted to the boiler tube*

copper, and the backplate is fitted with these screws at $\frac{3}{8}$ in. pitch.

Foundation Ring

This was made of $\frac{1}{2}$ in. square copper and was built up separately, pinned and brazed, and fitted to the awkward corners; when complete, it was close-riveted all round with $\frac{1}{8}$ in. diameter × 1 in. S.H. copper rivets, $\frac{3}{8}$ in. pitch.

Tubes and Tubeplate

There are four 1 in. o.d. × 16-s.w.g. superheater tubes, and sixteen $\frac{1}{2}$ in. o.d. × 18-s.w.g. firetubes, silver-soldered into the combustion chamber; two special three-roller expanding tools were made to expand them in at the tubeplate end, the tubeplate being made of 10-s.w.g. copper and flanged over the formers made, and the outside turned to fit inside the boiler barrel, and then close-riveted all round.

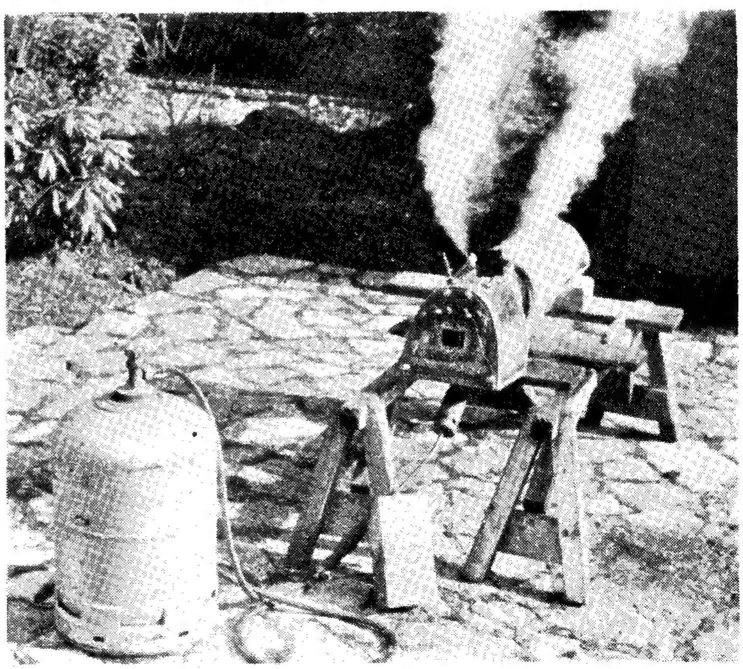
Riveting

All joints were riveted by $\frac{1}{8}$ in. diameter, copper snap-headed rivets, all at $\frac{3}{8}$ in. pitch, except the back-plate, as mentioned, which had 4-B.A. round-head screws at $\frac{3}{8}$ in. pitch, and were all tight and mechanically strong before the brazing operations were begun.

Brazing and Assembly

Being in the country, there is no town gas, so means had to be found to produce the high temperatures needed to combat the heavy losses through radiation with so large an area of copper. This consisted of Calor gas feeding a high-pressur torch (flame 2 in. diameter × 18 in. long), i.e. 25 lb. pressure direct from cylinder to the torch, with a No. 200 jet. This consumed such an enormous volume of the liquid gas, that in about 20 min. the bottom of the gas cylinder at liquid level was frozen every time, with a consequent reduction of pressure; so operations had to be arranged for a limited time only. To preheat the whole part while the actual brazing was going on a 5-pint blow-lamp was played on the boiler at the particular spot, through a 2-in. hole in a 3-ft. square asbestos sheet, for every operation, as even the torch and blow-lamp going together, were only just enough to create the proper local heat at the spot one was working on. All the various parts after drilling for riveting were bolted together with temporary bolts and nuts, and then were dismantled and thoroughly burred each side to ensure a tight face everywhere; and only one of these temporary bolts and nuts in every hole holding the parts together was removed and the same riveted up, and so on till all the assembly was complete.

The firebox, combustion chamber, and both cross and boiler tubes were all brazed together with Johnson Matthey's No. 2 Easyflo, ($\frac{3}{4}$ lb. of it !) and as it was essential to know if



(4). *The completed* 1-*in. scale boiler undergoing its* 100 *lb. steam test, with artificial firing*

this assembly was suitable for pressure *before* assembly into the boiler proper (an operation not often, if ever, carried out by boiler makers), the firehole door and base of firebox were temporarily closed with copper plates; also, the ends of tubes, and the whole of the space *inside* firebox were pumped up with air pressure, tested underwater, and proved completely satisfactory.

All other joints of the boiler after riveting were soldered, not brazed; but *not* with tinman's solder that melts at 175 deg. C., but with Johnson Matthey's "Comsol," a high-temperature special solder that flows at 300 deg. C., and is several times stronger than ordinary solder at superheated steam temperatures, all faces and joints having been previously tinned before riveting. This was necessary because, owing to the enormous volume of copper for radiation, getting on for 70 lb. weight, only an oxy-acetylene torch could have done the final job in the brazing way, and this was not available. All bushes, etc., for the boiler fittings were made of phosphor-bronze and silver-soldered with No. 2 Easyflo.

Staying

After assembly, the boiler was drilled for the stays which number over 70, and are of $\frac{3}{16}$ in. diameter copper rod screwed 40 t.p.i., with heads riveted over outside, and brass nutted on the inside. A lot of trouble was experienced here owing to the inability of manufacturers to produce taps and dies of accurate pitch (why not ground thread taps and dies ?), as the stays towards the centre of the boiler and firebox are over 1 in. long, and the creeping error of the die or tap produced as much as half-a-thread error in 1 in., with the result that stays would not screw in unless made very slack, which was not considered good enough, so other taps were procured till this pitch error was overcome, and all stays are of good fit before riveting up. There are four longitudinal stays $\frac{1}{4}$ in. diameter with 40 t.p.i. ends and nuts each end.

Testing

All fittings for the boiler were made, but with no holes in each of the parts; these were then used as plugs to plug up the bushes, etc., and so make a pressure-tight job all round.

The boiler was now filled with water and pumped up with the large double-acting pump to be fitted in the tender to twice the working pressure of 80 lb. per sq. in., 160 lb. and the only signs of defect were a few weeps on the stayheads, and on the eight phosphor-bronze drawing-up bolts on stays from firebox to crown. These were soon dealt with, and the test repeated several times till all was perfect.

For the steam tests, the safety-valves were removed (solid) and the valves completed and loaded to working pressure + 25 per cent., i.e. 100 lb. per sq. in., and refitted. The Calor gas torch was applied after filling the boiler with water, and within eight minutes all four safety-valves were blowing off hard 3 ft. high; see Photograph 4. This pressure was held for $\frac{1}{2}$ hr. and repeated after more water was put in boiler. This test proved quite satisfactory, and so boiler was certificated.

Time and Cost

Very few descriptions of boilers or even locomotives tell of this part of the work, but in this case, careful records were kept and are detailed here to show an astonishing story of effort and perseverance; so 1-in. scale "boiler-bashers," beware !

Times

Boiler proper, parts and assembly	264 hours
Bushes, etc. for boiler ..	29 ,,
All patterns for boiler ..	19 ,,
Boiler brazing, etc. ..	42 ,,
Stays and staying ..	25 ,,
Testing	25 ,,
All finished boiler fittings	59 ,,
TOTAL ..	463 hours

Cost

All raw material *only* ..	£24 12 3
Calor gas outfit ..	£8 8 3
TOTAL ..	£33 0 6

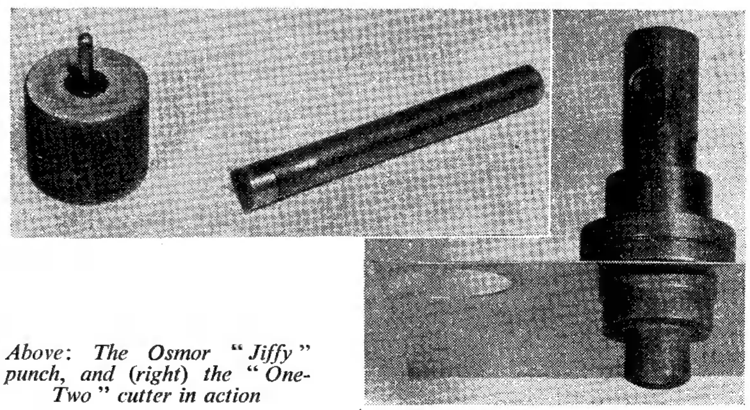
General

The boiler has now been fitted to the previously air-tested locomotive chassis

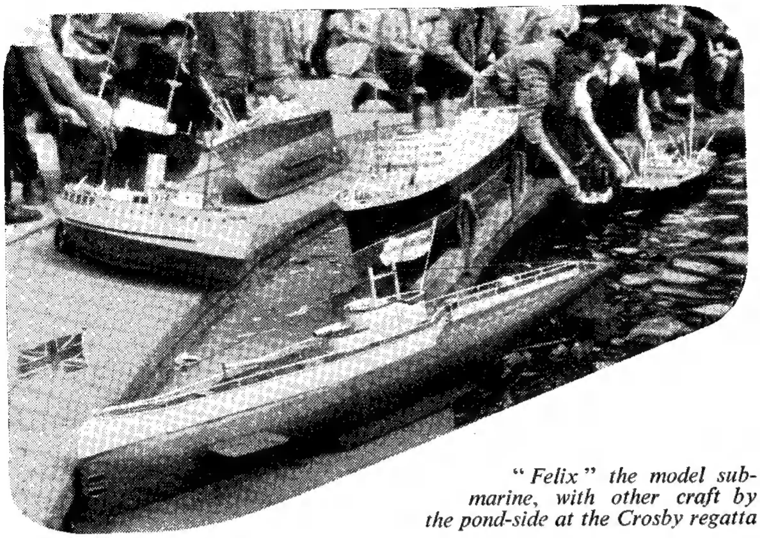
"OSMOR" PUNCHES

THESE tools have been designed particularly for producing clean, accurate holes in radio chassis, but are also useful for any kind of sheet metal work up to 18-gauge in steel or 16-gauge in light alloy. The set includes two complete tools, the "Jiffy" punch for holes $\frac{3}{8}$ in. diameter, and the "One-Two" chassis cutter for holes of two sizes, either $\frac{5}{8}$ in. and $1\frac{1}{8}$ in., or $\frac{3}{4}$ in. and $1\frac{1}{2}$ in. In the first case, it is necessary to start by drilling a hole $\frac{1}{8}$ in. diameter in the plate, to admit the pilot of the punch, which enables the die-block to be properly aligned. A sharp blow with the hammer completes the $\frac{3}{8}$-in. hole. For the larger holes, a $\frac{3}{8}$-in. hole is first produced to admit the shank of the second tool; the required size of punch is placed on one side of the metal, with its corresponding die-block on the other. The screwed drawbolt is then used to draw the punch through the metal. In tests with these tools, we find that they produce clean, accurate holes with minimum distortion of the sheet metal, and they can be employed where the ordinary methods of punching or drilling are impracticable.

"Osmor" punches are obtainable from tool and radio servicing equipment dealers, or direct from the makers, Perfex Accessories Ltd., Bridge View Works, Borough Hill, Croydon, Surrey.



Above: The Osmor "Jiffy" punch, and (right) the "One-Two" cutter in action



"*Felix*" *the model submarine, with other craft by the pond-side at the Crosby regatta*

A Working MODEL SUBMARINE

By H. A. Jackson

THE submarine described below was designed and built by Mr. J. Hinton of the Wallasey Model Power Boat and Yacht Club, and is built up of 22-gauge sheet tin, all joints being soft-soldered. Dimensions are as follows: Length O.A. 5 ft. 2 in. Max. beam 7 in. Height from deck to keel 8 in. and from deck to top of conning tower 3 in.

The hull was built up in three sections. The midship section (battery space) and the bow and stern section made separately, and added on. The centre section was made first of 22-gauge plate rolled into a cylinder and the bulkheads soldered in place. These are discs 7 in. in diameter. The bow and stern section were beaten to shape.

The bridge structure bolts down over an aperture cut in a false deck built up on top of the midship section. There is a rubber gasket in this joint. The aperture is large enough to allow for removal of the batteries.

The propulsion motor is a 6-volt Lucas dynamo suitably modified to act as a motor, and power is supplied by two 6-V. *Willard wet* accumulators—*Felix* has twin screws.

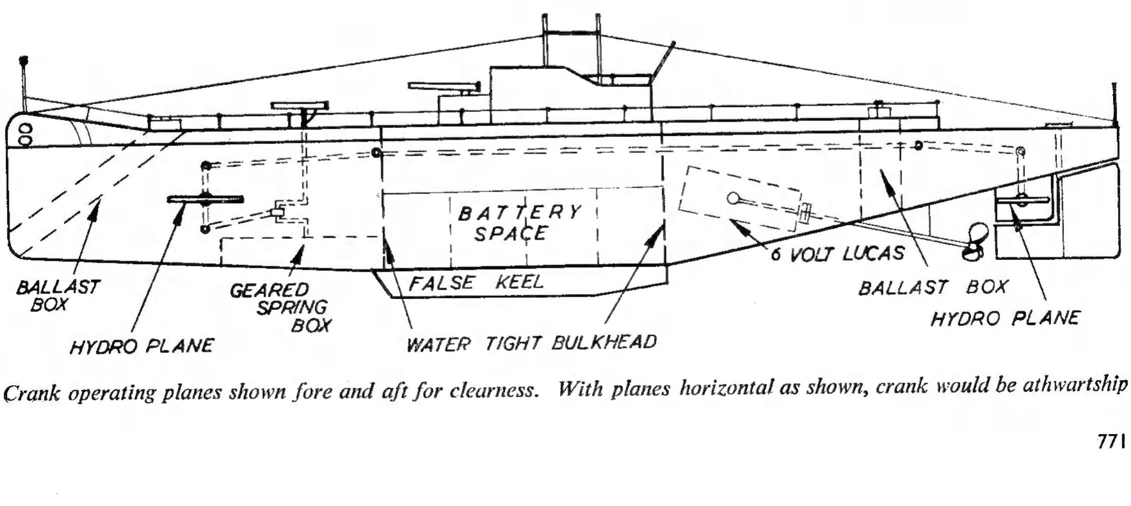
Two hydroplanes are fitted, bow and stern. These are actuated by an American clock movement operating through a cranked extension of the spring winding spindle of the clock (see sketch). The uppermost end of this extension is attached above deck to a dummy gun which rotates with the spindle. This is used to wind up the movement. A removable peg is then inserted into a blind hole in the deck, so as to limit the rotation of the gun. This allows the gun to make one complete revolution only, and is so placed that the movement of the gun is halted when it is facing forward, and the hydroplanes, therefore, in a horizontal position. It will be clear from the sketch that once the spring box is wound and the peg inserted, the spring is free to unwind to the extent of one turn of the winder (gun), and, therefore, depresses and elevates the hydroplanes, thus causing the submarine to dive and surface. This operation has been timed to take two minutes.

If the peg is left out (and the lake is large enough) the model will continue to dive and surface until either the spring runs down or the model hits the bank.

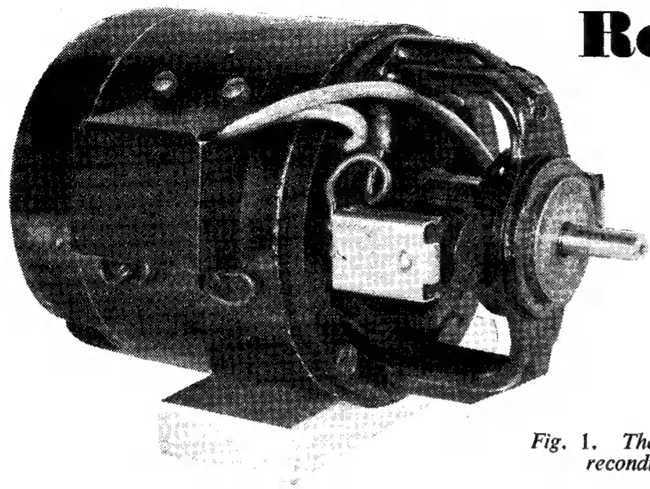
Felix's speed and the time taken by the hydroplanes to move from horizontal to an angle of approx. 45 deg. is sufficient to submerge her to a depth of 20 ft.. This, of course, requires a deep lake, and so a flat false keel was added (5 in. wide), and in shallow water she runs along the bottom resting on this keel.

A cycle inner-tube valve is fitted to the deck at the stern, and before release a few strokes with a pump puts air into the hull when the model is held under water. Any large quantity of bubbles rising indicates that the deck has not been secured properly.

The submarine floats in a normal position on the surface, with bridge and deck clear of the water, and is made to dive only by the action of the hydroplanes. In the event of any breakdown in the engine room, she will, therefore, surface—due to her own buoyancy.



Crank operating planes shown fore and aft for clearness. With planes horizontal as shown, crank would be athwartship



Reconditioning a small Electric Motor

By "Duplex"

Fig. 1. The motor after reconditioning

FROM time to time, small electric motors, suitable for running from the D.C. or A.C. mains, are advertised in this journal for sale at low prices. These machines may be either surplus goods in new condition or motors that have had considerable use.

Recently we bought in this way a second-hand, universal motor rated at 1/10 h.p. and wound to take current from the electric mains. Inspection showed that this was a machine of good quality, but as it had clearly had much use, a thorough overhaul seemed to be needed before putting it into service.

To begin with, the machine was stripped down and the accumulated carbon dust from the brushes was removed by turning on the air-blast, which plays an important part in the workshop in clearing away swarf and other debris. Following this, the parts were first washed in paraffin and then cleaned with petrol to remove all grease. It was now possible to see exactly where signs of wear showed and to make a start at carrying out the necessary repairs.

The Armature

The machine is fitted with two pairs of brushes, placed side by side, and as represented in Fig. 2, these had worn two deep grooves in the commutator. As there was plenty of metal in the copper commutator bars, the armature spindle was mounted between the lathe centres, as in Fig. 3, and a series of light cuts was taken over the surface with a knife tool.

For machining copper, the tool should be carefully sharpened and given plenty of rake; in addition, the point should be slightly rounded, but if too great a length of the cutting edge is in contact with the work, chatter may develop and spoil the finish.

After the machining, the commutator was finished with a strip of fine glass-paper; emery paper should not be used, as any abrasive particles becoming embedded in the surface will give rise to rapid wear under working conditions. Finally, the surface of the commutator should be carefully inspected, and any of the mica separators standing proud should be levelled with a sharp blade.

The Armature Shaft Bearings

One ball-bearing was found to be quite loose where it had been turning on the shaft, so that a groove, some 5-thou. in. in depth, had been formed, as represented in Fig. 4. To remedy this, a steel sleeve was bored and reamed to a diameter of exactly ¼ in. and, at the same time, the outside diameter was turned ½-thou. in. greater than the bore of the inner bearing-race. Next, the shaft itself was turned down to ¼ in. diameter, plus ½-thou. in., to give an inter-

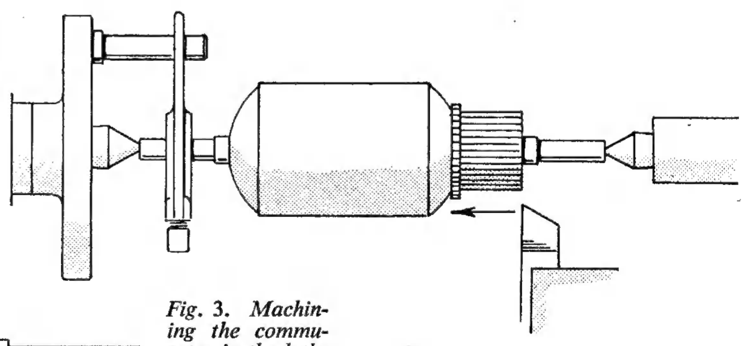
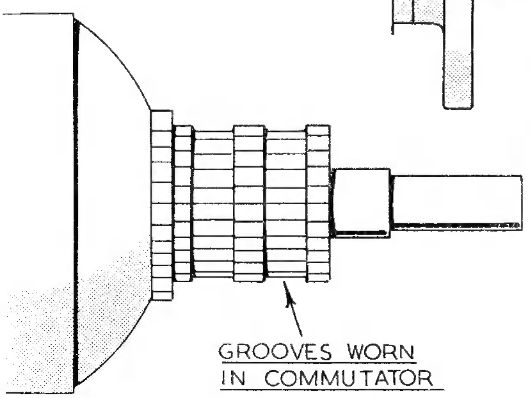


Fig. 3. Machining the commutator in the lathe



Left: Fig. 2. Showing the appearance of the worn commutator

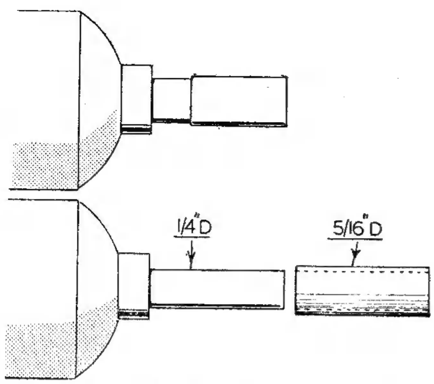


Fig. 4. Above—the worn armature spindle. Below—fitting the bearing sleeve

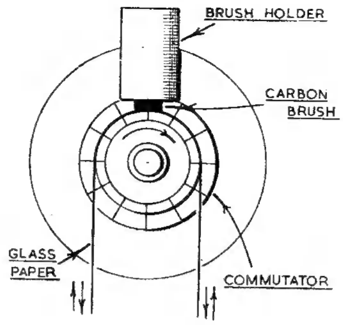


Fig. 5. Method of bedding-in the carbon brushes

Fig. 6. The thimble made for repairing the broken brush spring

ference fit in the sleeve. It should be noted that, when mounting the armature between the lathe centres, the shaft centres should, first, be carefully cleaned and any burrs removed. The outer race of the ball-bearing was a good fit in the motor end-plate, and it was removed by screw pressure, using a bolt and a recessed collar.

With the aid of a woodworker's clamp, the sleeve was pressed into place on the shaft. The armature was again mounted between the lathe centres and, with the work running at high speed, the outer end of the sleeve was filed with a fine Swiss file until the bearing could be pushed on to the shaft for a short distance, before being pressed home by again using the clamp.

Ball-bearings must always be treated with care and should not be subjected to hammer blows, for if the balls are driven against the races, the ball tracks may be dented and the bearing will soon fail in use. Before the bearing is replaced, it should be thoroughly cleaned by mounting the inner race on a wooden stick, and then spinning the outer race while the bearing is immersed in petrol or paraffin. The cleaning process is continued until no more debris comes away and the liquid remains clean.

The other ball-bearing was carefully drawn off the shaft with a small wheel-puller and then thoroughly cleaned. To prevent corrosion, the bearings should be oiled or packed with thin grease immediately after being cleaned.

The Brush Gear

The brushes were found to slide freely in their housings, but the contact surfaces showed signs of uneven wear and the brushes needed re-bedding. As shown in Fig. 5, this was done to each brush in turn by applying a strip of fine glass-paper to the commutator and then rocking the armature to and fro.

The cap retaining the brush is first removed, and the paper is pressed against the commutator with the thumb and forefinger.

While the armature is moved in the direction in which it turns when working, the brush spring is pressed down with the finger and the pressure is relaxed on the return stroke. The reason for doing this is that, if the brush rocks in its housing when the direction of rotation is reversed, the contact surface of the brush will be formed with a curvature that does not correspond with that of the commutator, but by taking the cut in the forward direction only, the brush will be evenly bedded. The brush should be examined after a few strokes have been made, and the bedding operation is continued until full contact is obtained. Brushes that are badly worn down and shortened should be replaced, as this reduces the effective spring pressure. The spring of one of the brushes was found to be broken and, as a replacement was not available, a repair was made, as shown in Fig. 6, by machining a hollow thimble to hold the broken ends and keep them from closing on one another.

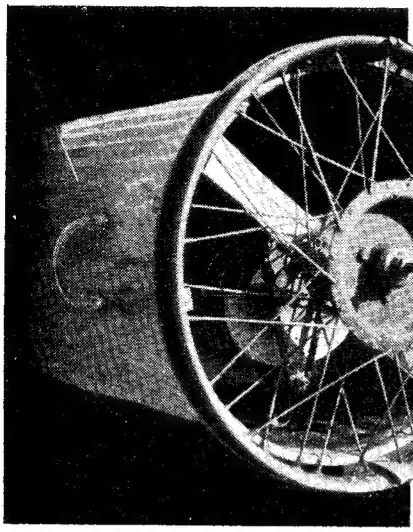
Final Assembly

Before the two end-covers are fitted, the ball-bearings should be lightly packed with thin grease. The wiring should be carefully gone over and any frayed leads protected with insulating sleeving. The leads from the field windings and from one brush are connected to a terminal block attached to the body of the machine; this enables the mains input leads also to be connected to the terminal block and loose wiring is avoided.

If the assembled motor is noisy when running, this probably means that the bearings are worn and need replacement; but unless there is appreciable play in the bearings, this should not be necessary. After the brushes have been re-bedded, there may be some sparking at the commutator; but, if the machine is in order, this will soon disappear as the brushes acquire a smooth working surface.

"METALFIX" SUPER ADHESIVE

This new preparation can be used either as an adhesive or a "cold solder" for constructional or repair work in wood, leather, plastics and metals of all kinds. In its standard form it has a metallic base, resembling aluminium when dry, but we understand that an alternative transparent adhesive of similar character will also be available. We have tried out a sample of the standard preparation and find it very useful for model engineering purposes. It can be used for stopping cracks and hollows, building up surfaces, or as a filler for smoothing rough castings prior to painting or enamelling. When dry it can be cut or filed, and is resistant to heat, water and acids. "Metalfix" is supplied either in bottles or tubes, and is stocked by tool dealers, ironmongers and handicraft shops throughout this country.



A WIND TUNNEL FOR FLASH STEAMERS

By J. A. Bamford

Exhaust end of tunnel, showing chain-driven fan, mounted in a motor-cycle wheel hub

I HAVE been interested in flash steam as applied to model power boats for some years, and, while not having achieved any success on water, I have had a lot of fun carrying out experimental work.

I have often discussed the problem of boilers and blowlamps with the acknowledged experts, and they all stated that the furnace department was number one snag. I, of course, being an ignorant beginner, had my own opinions and had the temerity to voice them, the result being that I was the recipient of a certain amount of " needling " to the effect that I had not got a blowlamp running on the water, and that one running on the bench was a very different kettle of fish.

Floating Test Bed

After having stood this for a while, I was stung to action and produced a horrible contraption in tin-plate that was to be a floating test bed, because to have called it a boat would have insulted the rest of the breed.

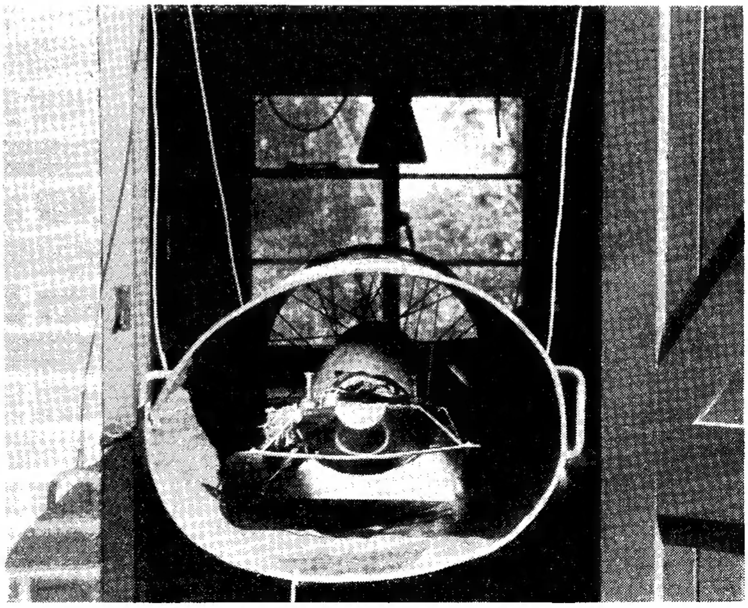
Most of my flash steam work has been done on turbines, but this effort contained an experimental piston engine built to test a form of valve-gear which is operated by the piston.

The first time I had it in the water I realised that the words of the masters were not idle ones, and that, in other words, I had lamp trouble. What sort of lamp trouble ? Ah, now here is the snag; the boat may run well when held statically in the water, but when it is running round the pole and a draught is blowing over the boiler and lamps, the combustion can be severely upset. I fiddled with jets and air holes, with scoops and cowls, and finally managed to keep the flame alight when on the run, but I suspected that combustion was still poor, as the top speed was 40 m.p.h., and I had good reason to believe the engine was working well.

Having got the boiler to produce a fair amount of steam while moving, I decided to return to my old love, the turbine. Several reasons can be given for this, the chief being the appalling state of the inside of the engine due to the hot steam. Another was that, after every run, the boat was covered with steam oil and was a revolting mess.

Lamp Trouble Again

The first run with the turbine showed that I had my old trouble with the lamps back again, although the boiler configuration was the same as before. All efforts to cure the trouble were fruitless and I realised that to get it right a wind tunnel was required, as, when on the water, the lamps always went out some thirty feet away, and I could not see what was happening ! I toyed with the idea for several months and finally came to the



Inlet end, showing boat in position

conclusion that if the wind tunnel fan was driven by the boat engine, the breeze would be proportional to the power output of the engine, and the fan would act as a load to the engine. Matching the fan pitch to the engine output was accomplished by making the fan an inefficient shape (only too easy) so that it swallowed more power than it might have done. This gave a simulated water drag, and the net result was that I had the engine running flat out and achieving approximately a thirty mile an hour breeze, which was what I estimated the boat would do with the power available, and equals about 1 b.h.p.

Wind Tunnel de Luxe!

The tunnel was made in one afternoon and, although crude in the extreme, is remarkably successful. The tunnel proper is made from two time-expired dust bins bolted end to end (there was no need to remove the bottoms), with the handles in line to act as supports. The fan bearing is a very ancient motor-cycle wheel which is attached to the rear end of the dust bins. The drive from the boat is taken from a small sprocket in lieu of the propeller, via a fine pitch chain, to a large sprocket carried on the wheel spindle. The fan is carried on the same side of the wheel, and when made, consisted of a piece of dural 16 in. $\times$ $2\frac{1}{2}$ in. $\times$ 10-s.w.g. twisted to some arbitrary pitch best found by experiment.

The boat is simply placed in the tunnel on its wooden stand and is held by a clamp that embraces the skeg bearing, and is adjustable vertically to take care of chain tension.

The whole contraption is slung in the workshop doorway with the exhaust end outwards. This arrangement is very convenient as runs can be made at night without groping around with torches. It is a somewhat sobering thought, however, that one's escape route is blocked by a screaming, flame-belching piece of machinery. I therefore have the window open in case I have to bail-out in a hurry. The photographs show details of the tunnel.

The method of operation is very simple. The tunnel is hung in the doorway and tethered to a 56 lb. weight to stop it swinging.

The boat is filled with fuel and placed in the tunnel, the skeg clamp being made fast and the chain tension adjusted. Water is supplied through a plastic tube from a one pint bottle placed by the tunnel mouth. The time taken to set the whole thing up and light up is about ten minutes, and it can be packed away in less time than it takes for a crowd to gather.

When running, the effect is somewhat terrifying, as there are clouds of steam and sheets of flame, apart from the fact that one is shut in a shed seven feet by six feet and it might blow up at any time. Water consumption can be checked by use of the pint measure, and r.p.m. can be measured by an assistant at the back end (if he is brave enough).

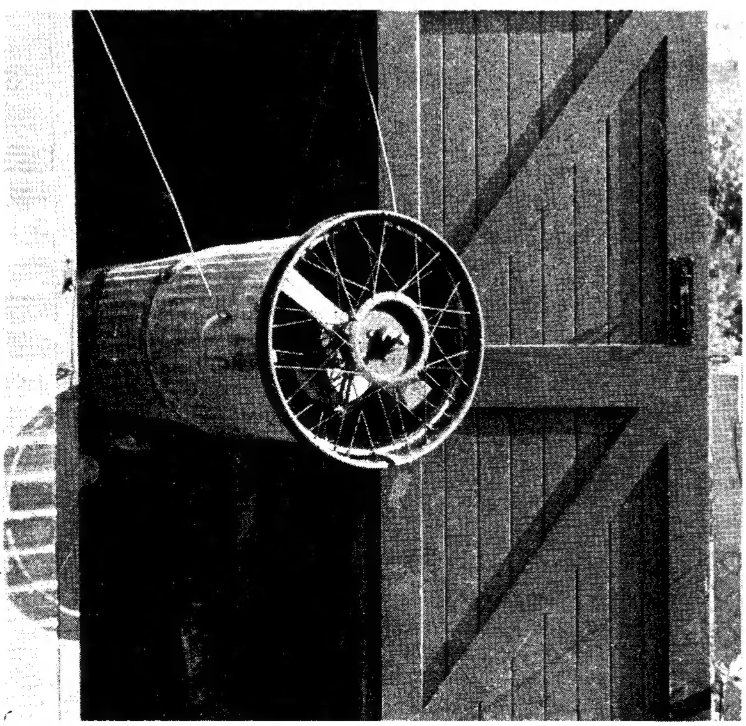
Temporary Hitch

My first run went well until there was a loud bang and the turbine started to race. I hastily shut down and looked to see if the chain had come off. It had not, but the fan blades had. Heat and centrifugal force were too much for them. I made a new fan from a piece of stainless steel and no more trouble was experienced.

Quite a powerful draught is set up, and I soon found the best type of air entry to the boiler. I found that with a forward facing scoop, the boiler casing could be got red-hot all over, but only if the lamps were set on the rich side to begin with. It therefore seemed logical that, as the speed increased, more fuel would have to be fed to the lamps to prevent them going weak again. When a draught shield was fitted the boiler worked poorly and a long yellow flame came from the rear, as opposed to a short blue one in the former case. I endeavoured to take some photographs of the different flames, but they all appeared much the same when developed.

While this tunnel has its limitations, I feel that it is quite a useful tool and could be used to sort out pump troubles. For instance, I found that with one type of nozzle fitted to the turbine the plant would run for about fifteen seconds and then stop. I quickly traced it to the fact that steam was escaping into the hull and warming the fuel pump. A piece of bent tin to deflect the steam cured the trouble.

This scheme is capable of considerable elaboration, and as mine was built in about two hours, anyone who cared to spend a couple of weeks could have a really efficient job. One refinement intended to be incorporated in mine was a rocking mounting for the boat with torque-arm attached, so that b.h.p. could be measured. I will now leave it to the experts to criticise.



The complete test tunnel suspended in the workshop doorway

Headstocks for a Milling Machine

By R. L. Bell

OWNERS of "Pools" bench milling machines may be interested in the attachments about to be described. The scope of the machine is greatly enlarged, and work such as gearcutting and cutter making can be carried out very easily and quickly with its aid.

The principle underlying the attachment is the use of the lathe change-wheels as the means of indexing. Practically all gears produced today have "generated" teeth, which process maintains the pitch accuracy, even if tooth form may not be quite perfect.

My own set have a bore of ¾ in., and go up in fours from 18 to 100 teeth, not including the 127, which, of course, can be counted out for dividing purposes. The whole set gives a very useful combination of divisions.

The design is extremely simple, but very sturdy. With regard to the dimensions, due consideration was given to the machines to be used in making up the various bits and pieces. These consist of a 4 in. lathe, a 7 in. power shaper, and, of course, the milling machine on which the finished attachment was to be used. Should it be desired, at a future date, to fit a conventional worm drive, with division plate, the alteration will be very simple : a 40-tooth worm wheel on the spindle, in place of the change-wheel, and a worm bracket on the boss, at present occupied by the detent arm.

Pattern making had to be kept to a simple minimum, and so it was decided that both the head- and tailstock castings were to be made from the same pattern. This idea seemed sound, and so a pattern in halves was made for the main heads, together with plain ones for the detent arm and catchplate, respectively.

At this juncture, it may be well to remark that fair accuracy was aimed at, if the finished job was to fulfil its purpose properly, and so a good deal of thought was given to the methods to be used. The spindle bores had to be quite parallel, so that the centres would coincide when placed point-to-point, and also parallel to the base surfaces and to the table sides.

The boring job would be quite simple on a lathe boring table which is *quite parallel* to the lathe bed on its upper surface. Most important, that ! But in my case, my lathe has no boring table, an omission, I hasten to add, soon to be rectified ! Things being so, the following method was evolved, which turned out quite satisfactory.

Castings were made by a local foundry and were excellent, the cored hole nicely centred, and the iron, while not really soft, was homogenous with no hard spots.

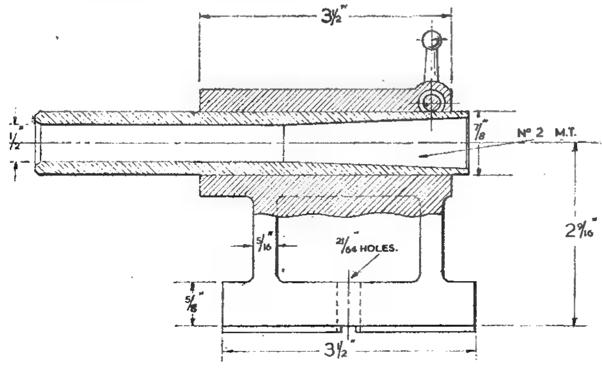
A block of metal about 1 in. thick, 2 in. wide, and about 8 in. long, was available, and this was bolted squarely across the shaper table. A vee groove was machined across it, large enough to seat the barrel portion of the casting. With a ⅝ in. square bar, drilled to take holding bolts, passed through the corehole, the castings, one at a time, were held down securely, and the base surfaces machined down to about 0.015 in. of finished thickness. The tenons were rough-machined to measurements obtained from the miller table itself.

The casting sides were finish-machined at this stage, afterwards being secured to an angle-plate, dead square, to machine the other two sides. Bolt holes were marked. off and drilled just prior to the latter operation.

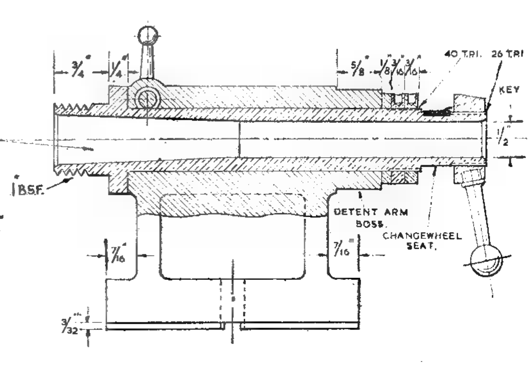
This process ensured that (a) the tenons would engage the same "tee" slot in the miller table when the heads "faced" each other with the barrel locks adjacent to each other, and (b) the barrels of the castings would be true with the bores.

To arrive at the exact width of the "tee" slot, a piece of steel plate about ⅛ in. thick was filed to a close fit, and afterwards measured with a "mike." The tenons were left 0.010 in. oversize at this stage and were positioned from the casting sides accordingly, by means of a "mike" depth gauge.

The next step was the marking-out, drilling, and reaming of the barrel lock holes in the bosses provided. The castings, suitably packed underneath, were mounted on the miller table and the sides of the bosses cleaned up with an end-mill. Centres were marked, the castings bolted to an angle-plate on the drilling machine, and the holes drilled, letter "U" size, followed by a ⅜ in. reamer.



TAILSTOCK.

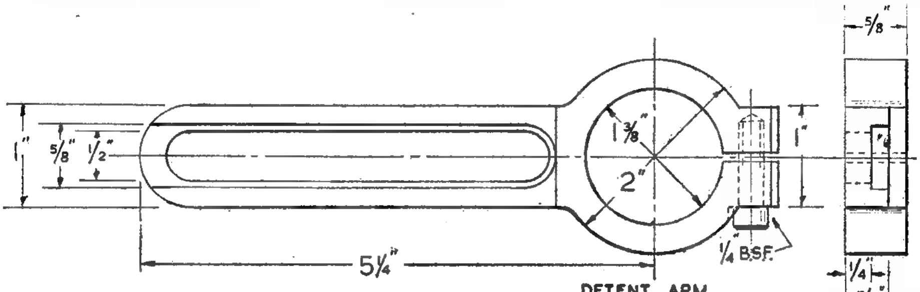


HEADSTOCK.

Referring to the drawing, it will be seen that the barrel locks take the form of a deep head formed on the bolt, and a sleeve, the locking action being accomplished by tightening the two elements towards each other by means of a ball lever nut. The locking action is very definite, with the minimum of pressure, and, the forces being balanced, very little displacement of the barrel can occur.

The two members, when made, had a $\frac{1}{16}$ in. thick spacer placed between them, and the diameters of the bolt head and sleeve were such that the complete unit was a light drive fit in the hole. An ordinary nut held the parts together, and they were tapped into such a position in the hole that the distance piece coincided with the centre line of the, as yet, unfinished bore. After boring, of course, the spacer was discarded and the outside of both bolt and sleeve was carefully eased down to a close sliding fit in the hole, the bolts being finally furnished with a ball type lever nut. These lever nuts were produced with two simple form tools for the ball ends, and were machined to give a 15 deg. slope when in position.

The lathe now came in for a spell of real duty. It is a 4 in. "Murad," and if ever the clutch I made and fitted (described in the "M.E." last year) earned its corn, it did on this occasion !



DETENT ARM.

The angle-plate, checked for truth and not found wanting, was taken and a piece of $\frac{1}{16}$ in. thick steel strip, $\frac{1}{2}$ in. wide, secured to the inner face, dead square to the front edge by 4-B.A. countersunk screws, and in such a position that with the side of the tenon hard against it, the barrel centre line was central with the plate. The casting was secured, by its own boltholes, with two $\frac{5}{16}$-in. bolts to the plate, and the whole combination secured to the lathe faceplate.

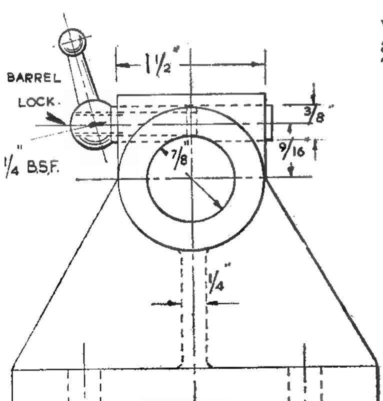
The angle-plate was then moved about until measurement showed that the bore centre height was correct, balance weights were added, and rotation showed that the casting ran quite truly.

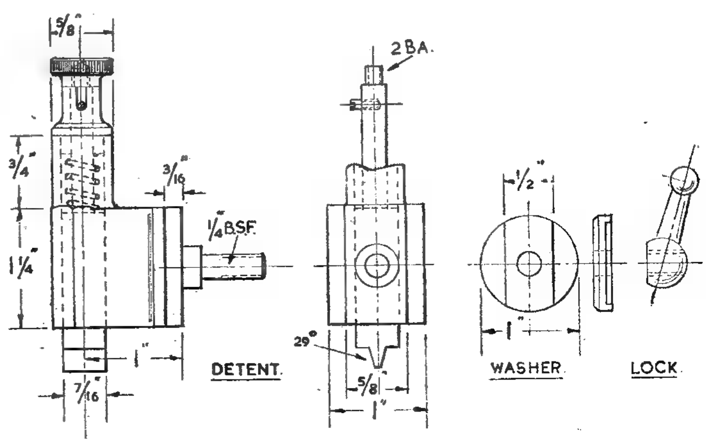
The first casting was mounted with the locking boss outwards, and was faced only, after boring. The second was mounted locking boss inwards, and was machined to receive the detent arm after facing and boring. Both bores were finished with a reamer, and came out clean and true.

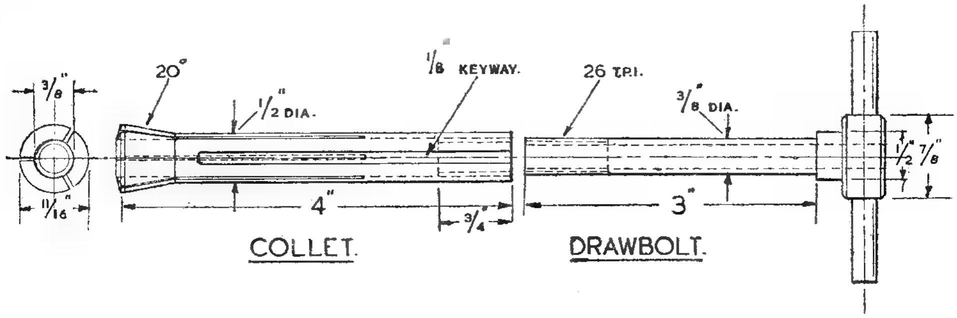
The final operation was done on the very machine for which the heads were designed, namely, the miller. A mandrel was carefully made, dead parallel, and a stiff push fit in the bores, and about 4 in. longer than both heads when placed together with their bases touching, and with the locking bosses facing each other. By locking the castings separately on this mandrel, the facing of the unmachined ends was done.

The boltholes were next counterbored $\frac{1}{2}$ in. dia. and $\frac{3}{16}$ in. deep in the underside of the base surface, after which the two castings were mounted together on the mandrel, lined up, and firmly locked. The whole assembly was then stood upside down on the miller table with the mandrel extension at each end in vee blocks, and temporarily held by a small clamping plate at each end.

Four long bolts were made from $\frac{1}{4}$-in. rod having slotted heads, $\frac{1}{2}$ in. dia. by 5/32 in. thick, riveted on one end, and about 1 in. of thread cut on the other. The length of these







COLLET. DRAWBOLT.

bolts was established by measurement, and two $\frac{5}{8}$ in. × $\frac{3}{16}$ in. strips were made, drilled and tapped the exact distance apart of the boltholes, and slipped into the "tee"-slots.

The bolts were introduced through the boltholes and picked up the strips in the slots. Before setting and tightening, however, a small block of metal was filed just to pass stiffly between the table surface and the exposed central portion of the mandrel for support purposes.

The whole set-up was then finally positioned by means of a "clock" indicator, readings being taken from the vertical knee slides of the machine. When readings were identical from both ends, the mandrel was firmly clamped at both ends, the castings aligned horizontally with the table, and the bolts then carefully tightened down, using a large screwdriver in the slotted heads.

A final check all round proved that nothing had moved, so the machine arbor was placed in position, on which was mounted a 1 in. wide slabbing cutter. With this the bases were cleaned down to finish thickness and the tenons were finished with a $\frac{1}{8}$-in. cutter to the width indicated by the small gauge previously made. A small undercut, 1/64 in. deep, was formed on both sides of the tenons to give a clean corner.

Having dismantled the whole set-up, a check on the table showed that all was in order, and with the castings held down, the bores aligned perfectly.

The question of the head and tail barrels now came up. Here again, accurate concentricity was called for. A $6\frac{1}{4}$ in. length each of $1\frac{1}{2}$ in. and 1 in. steel shafting was obtained, and each in their turn mounted dead true by one end in the four-jaw chuck, and by the fixed steady at the other. Centring and drilling half through, and the forming of a small 60 deg. countersink did not take long, after which, reversing in the chuck, setting true and again drilling, soon had a true hole right through.

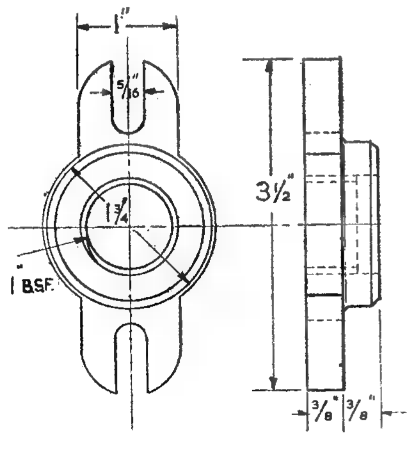
Before removal, however, the hole was bored out No. 2 Morse taper, using a centre as a gauge, and as before, a small 60 deg. countersink was formed at the mouth. No outside turning was done at this stage, but in the case of the head spindle, a small length at the end was reduced to something just over 1 in. to take a lathe carrier.

Both spindles were rough-machined between centres and put aside. A piece of 1 in. round steel was put up in the three-jaw chuck, and a No. 2 Morse taper turned on it, using a socket as a gauge. A piece of thin, strong paper was cut to cover the taper without overlap, and the head spindle tapped firmly on to it. The tail centre was brought up and all machining and screwcutting completed "at one go." The result was a perfectly true spindle.

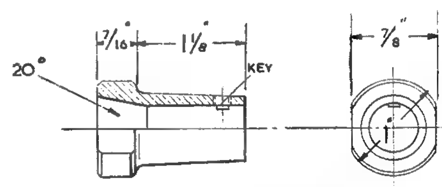
The tail barrel was given a dose of the same treatment, and in both cases the last "$\frac{1}{2}$-thou." was removed by lapping until a close push fit was obtained in the casting bores.

Without removing the taper mandrel from the chuck, the collet nosepiece was turned and bored, the piece being parted off and afterwards held in a sleeve placed direct in the lathe mandrel nose, for forming the 20 deg. mouth for the collet.

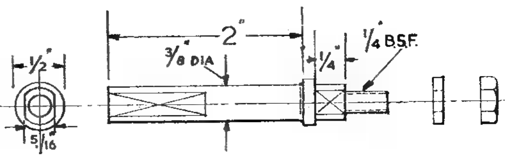
The next part to be taken in hand was the detent arm casting. One of



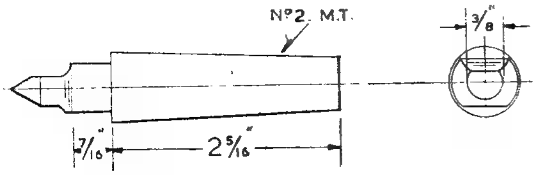
CATCHPLATE.



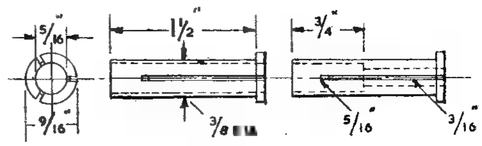
COLLET NOSEPIECE.



DRIVE PIN.



CENTRES.



COLLET LINERS.

the first things I fitted to the milling machine was a collet and nosepiece identical to the one being described, and it has proved very useful for holding endmills and other cutters.

To resume, the casting was held plain side up in the machine vice on the shaper table, and that side machined. Two ¼ in. holes were drilled through the, as yet, solid, central web, and having removed the vice, the casting was screwed down to the shaper table, using the tapped strip in the tee-slot as before. The boss and arm were then faced down to their respective thicknesses.

The casting was then removed to the milling department, mounted on an angle-plate, and the slot and groove endmilled out to width. The seating for the head of the "Allen" cap-screw was milled, followed by the drilling and tapping for its accommodation. Mounting on the lathe faceplate and boring the boss, followed by slitting the lug with a 1/16-in. cutter, completed that component.

The detent body was machined out of a solid piece, and care was taken to get the fit of the silver-steel detent really good. The hole in the block was reamed right through and the top guide plug turned to a press fit. The milled edge around the knob was done on the attachment after completion, and acted as a good "test piece"! The spring is fairly strong, and the detent is held out of engagement by a peg turned at 90 deg. out of its slot.

The 29-deg. tip was machined in the shaper, and it was important that it was formed truly diametrical. To this end, a true diametrical line was scribed while in the lathe, and lines 1/32 in. either side marked to act as "witness" lines when forming the tip. The angle of 29 deg. was necessary, as being of rack tooth form, it contacts the teeth as nearly as possible on their pitch line.

The washer was turned and drilled on a short stub of bar, and the rebates milled, afterwards returned to the lathe and parted off. The ball locking lever came next, and soon joined the other components.

A loose close-fitting ring, and two circular locking rings were machined from a piece of bar at one setting, the 40 t.p.i. internal threads being cut to give a close fit on the spindle thread. A ⅛-in. tommy-bar hole was drilled in the edge of each for locking purposes.

The feather-key seat was end-milled and a key fitted to take the ⅛ in. keyways in the change-wheels, and the outer retaining nut made and screwcut 26 t.p.i. to match the spindle tail. The ball handle lever was screwed tightly into a flat-bottomed hole tapped 9/32 in. × 40 t.p.i., the hole being counterbored to form a flat seating for the shoulder of the shank. This lever could have been brazed in position, but as all the turning had been carried out with a bright machined finish, it seemed a pity to spoil a component by the necessary heating.

The catchplate casting was a simple straightforward component, the screwcutting alone being "fussy," as a good fit on the spindle nose was deemed necessary. The slots were milled out after drilling a hole at the root of each lug, and were done while mounted on the actual attachment to ensure truth. The catchplate pin was a simple turning job, together with its washer.

The collet was made from silver-steel, turned and reamed at one setting to ensure truth, afterwards being tapped ⅜ in. × 26 t.p.i. to take the draw-bolt. This latter was drilled through ¼ in. to form a hollow spindle. The collet was split in three places and a ⅛ in. keyway was cut to accommodate a peg key turned on the end of a rod screwed 2 B.A. This peg was screwed tightly into a hole drilled and taper-tapped in the nosepiece, being afterwards cut off and filed flush.

So far, three collet liners have been made, of 5/16 in., ¼ in. and 3/16 in. bore to take small rods and spindles. Others will follow as jobs demand. They, too, are made from silver-steel. The centres are standard articles and could at a pinch be "borrowed" from a lathe, but mine were presented to me by a friend many moons ago, and are ideal for the job, being small at the tip, and having flats to reduce their "interference factor."

It will be seen from the foregoing that the attachment has many uses. The centre height is such as just to clear nicely a 5 in. circle. The fact that no fancy screw is employed to advance the tail centre is no deterrent whatever to the good support of work held between centres. Under these conditions, however, a forked carrier with clamping screw is necessary, or conversely, a bent-tail carrier with a screw in the catch-plate slot must be used to prevent movement of the work.

Quite a collection of small special cutters have been quickly made and have proved their worth on quite a number of occasions, and in fact, the attachment has increased the usefulness of the milling machine to a great degree.

The finishing touches were four coats of light grey paint, well rubbed down between coats, and with the edges of the bases and detent arm polished, the whole is as pleasant to look at as it is to use.

GUIDE TO DIE-CASTING METHODS

Described as a "brief but practical guide which it is hoped will interest and help executives wishing to explore for their products the possibilities of die-casting" a current brochure produced by Dyson & Co., Enfield (1919) Ltd., Southbury Works, Ponders End, Enfield, Mddx., contains a wealth of information on this and allied processes.

Of particular interest from the engineer's and craftsman's point of view is a chapter on the importance of the toolroom to the die-caster.

This concern, as may be imagined, has a fully-equipped toolroom and a team of craftsmen who have had years of experience in the art of mould making, in which the company takes a considerable pride. With this equipment and those skills, it is able to construct moulds to the closest working limits.

CUP COLLETS FOR A PRECISION LATHE

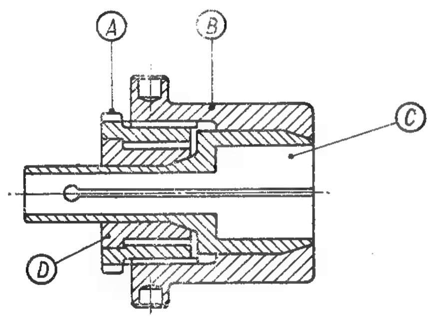
By K. N. Harris

NO lathe user who has had any considerable experience on a lathe equipped with collets needs any convincing of their outstanding merits.

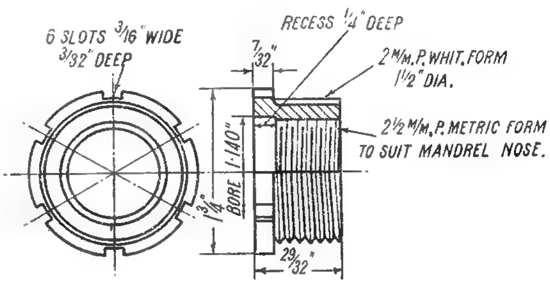
From the point of view of many amateurs, their value is qualified by their limited capacity, for the average lathe built for his use rarely has the mandrel bored out to a size greater than $\frac{3}{8}$ in. diameter, whilst there must be thousands of small lathes fitted with No. 1 Morse taper centres, and having a mandrel bore of $\frac{3}{8}$ in. full only, $\frac{7}{16}$ in. can be used in short lengths. The limiting factor, of course, is the screwed tail of the collet, which is reduced below the diameter of the collet body, so as to make room for the hollow drawbar.

For long I have found this limitation something of a nuisance; both $\frac{7}{16}$ in. and $\frac{1}{2}$ in. stock are useful sizes to be able to use in long lengths and the ability to chuck, with certain accuracy, short lengths of larger stock would be a considerable time-saver and facilitate a better standard of accuracy being attained times in various sizes and never had any trouble with it, though other things being equal, I have a sneaking preference for the " draw-in " system.

The appended drawings show what was done, and one advantage of the " push-in " system as here worked out is immediately evident. With the " pull-in " system the closing effect takes place well behind the cup, leaving a lot of the actual jaw unsupported. This is not too bad in small sizes, for fine work, but when we come to 1 in. diameter stock, it is a different matter. With the " push-in " system, one can take advantage of the taper in the mandrel more on the one side, and add a taper reverse angle, at the front of the collet, with which the closing-piece mates. It is, of course, essential that the nose adaptor, and closing-piece are accurately screw-cut to their corresponding thread fittings, and absolutely concentric, but this is merely a matter of careful workmanship.



Assembly in section: A—False nose; B—Closing-piece; C—Collet (1 *in. size shown*); *D—Mandrel nose*



(*A*) *Detail of false nose* (1 *off, KE* 805)

which figures strictly limit, (a) the size of the collet itself that can be accommodated, and (b) the diameter of bar that can be passed through the tail of the collet.

A great deal of the amateur's work is done on short lengths of bar, larger than his collets can take, which have to be held in the 3-jaw s.c. or 4-jaw independent chuck, and where re-chucking has to be done, or the job has to be reversed end for end, a good deal of time is taken up setting the job true, and the degree of accuracy obtained is not always up to the standard desired.

My Boley 90 mm. centre lathe has a mandrel made to take collets direct, without any adaptor, which, of course, is ideal for accuracy. The largest through rod that the collets will take is $\frac{3}{8}$ in. though with numerous day-to-day jobs.

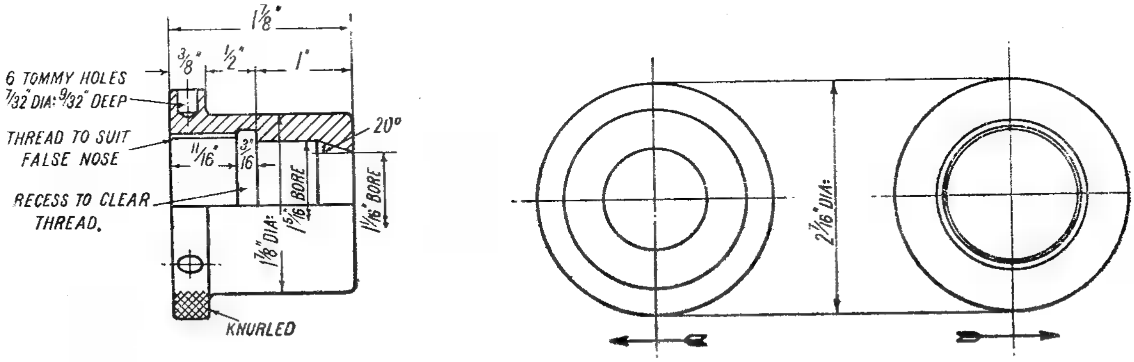
A fairly satisfactory answer lay in making a set of cup chucks, on the collet principle. The late Geo. Adams used this name, though I believe in the collet trade they are known as " crown " collets; as, however, the use of the word " crown " might lead to confusion with the excellent range of s.c. and independent chucks bearing that trade-mark, and as cup chuck is much more descriptive, I prefer to use that name.

As made commercially, these chucks or collets are usually on the " draw-in " system, but, in my case, to use this system would have meant that I should still be restricted to $\frac{3}{8}$ in. diameter for long bar work, so I decided on the " push in " system. I have used this many

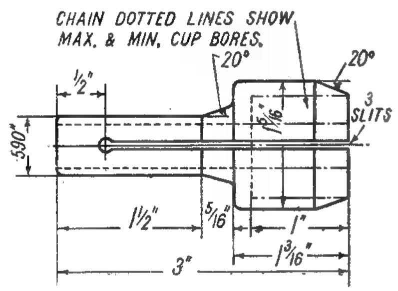
By using this system, as well as the cup chucks proper, i.e., chucks having [illegible] cup capacity greater than their through bore, I can fit two collets which, while externally cup collets, are internally plain rod collets, to take $\frac{7}{16}$ in. and $\frac{1}{2}$ in. bar right through. Here it might be opportune to point out that a collet should never be used with rough or untrue stock, never, with stock *over* its nominal capacity, and preferably never with stock of a size less than its nominal capacity by an amount exceeding 0.5 per cent. (half of one per cent.).

In other words, a collet is a precision instrument and should be treated as such, or its precision will quickly be lost to sight, though it may remain to memory dear!

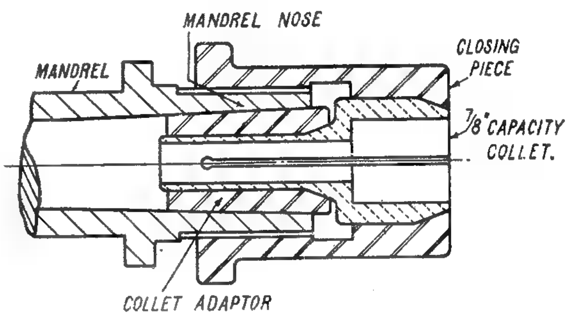
The [illegible] of the false nose-piece



(*B*) *Detail of closing-piece* (1 *off,* " *Ubas* ")



(*C*) *Detail of collet* (9 *off, KE* 508). *Cup sizes*: 1", $\frac{7}{8}$", $\frac{13}{16}$", $\frac{3}{4}$", $\frac{11}{16}$", $\frac{5}{8}$", $\frac{9}{16}$", $\frac{1}{2}$" & $\frac{7}{16}$". *All collets except* $\frac{1}{2}$" *size bored and reamed* $\frac{7}{16}$" *through tail. Note*: $\frac{1}{2}$" *size bored* $\frac{1}{2}$" *right through*



Arrangement to adapt collets to 4$\frac{3}{4}$ *in. centre Adams Pittler lathe*

enables a much larger collet to be used than would be the case if the mandrel nose were used direct to take the closing-piece.

The collets themselves were made from K.E. 805 steel, as I had sufficient of this excellent material heat treated to the limits of reasonable machineability, available, but good quality mild-steel is a perfectly satisfactory material for all normal requirements of the amateur.

The false nose-piece was also made from the same material, whilst the closing-piece was made from " Ubas " steel and case-hardened. A keyway (not indicated on the drawing) was cut in the body of each collet, to accommodate the peg key in the mandrel bore.

The collets should be finished bored *in situ* on the lathe, care being taken to secure the maximum possible accuracy, combined with good surface finish.

The sawcuts are, of course, made *after* boring, and, in fact, this is the last machining operation. The exact width of the slits is not important and may be anything from 30 to 50 thou. (0.030 tp 0.050 in.).

Any " kerf " left in the bore by the saw-cuts should be carefully stoned off with a small round or half round abrasive stick, or a dead smooth half-round file.

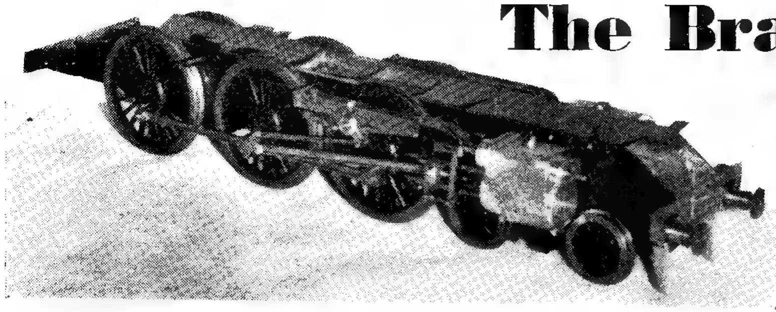
When using the collets be sure the threads of adaptor and closing-piece, internal bore of mandrel and surface of collet are quite clean and free from grit ; lubricate threads and working surfaces with a drop or two of thin oil.

Of course, where a lathe mandrel is not adapted for taking collets direct, the false nose-piece or internal adaptor will have to be differently designed, and a separate drawing is shown of such an internal adaptor and closing-piece which I made to enable me to use the same set of collets in my 4$\frac{3}{4}$ in. Adams-Pittler lathe, which has a nose approximately 1$\frac{9}{16}$ in. dia. over threads. This drawing should suffice to make clear the general idea. A set of chucks of this type are unquestionably a very valuable accessory, as for many classes of work, they not only expedite the job very considerably but they assist materially in the attainment of greater accuracy.

A NEW LACQUER

The Leyland Paint and Varnish Co. Ltd., of Leyland, Lancs, have introduced a new all-purposes lacquer which is very easy to apply, and is suitable for interior or external use on wood, metal, and other materials. It is economical in use, having exceptional covering power, and dries hard in two hours, giving a high-gloss finish, which will withstand temperatures up to the boiling-point of water, and also resist water, oil and grease. One coat is sufficient in most cases, except where light colours are used on dark surfaces.

This preparation is known as " Qik," and is obtainable in 24 shades of colour, also black, white and clear lacquer, in 1-pint tins, from hardware or colour stores. We have tried out a sample tin of " Qik " for model work in both wood and metal, and find that it substantiates the claims made for it by the makers.



The Bradford Exhibition

Reported by " Northerner "

Chassis for another ¾-in. scale " Royal Scot," which is being built by A. Hutchinson

THE name of Harry Booth, of Bingley, has appeared fairly often in these reports of Northern exhibitions; but, of course, he is so prolific in his model-making, and besides his models are of such an excellent quality. This last must be said of his locomotive *Britannia*, which is the first example I have seen finished of this particular locomotive built to " L.B.S.C.'s " " words and music." The engine has already performed well on the track, the only trouble being with the regulator, which has now been rectified. The tender was not exhibited, since it was not finished, but the engine certainly is a grand effort. The green paint was too pale, but this may be due to the fact that it was only completed in time for the show, and could not be corrected.

Incidentally, this locomotive is the result of a friendly bit of " kidding "—some of Mr. Booth's fellow-club-members swore that he could only build stationary engines, so that *Britannia* has been built to " larn 'em different." Perhaps they'll stay larned, now, Harry !

Another popular " L.B.S.C." design is *Molly*, the 0-6-0 L.M.S. tank-locomotive, and H. Wood of Bradford has built a nice example, of which, however, the paint could be smoother. It was rather " bitty," possibly due to particles in the paint which could have been strained out.

The president of the Bradford club, W. Ashworth, exhibited his 3½-in. gauge *Royal Scot*, which, in the five years since it was built, has run more than 250 miles. She has obviously been well looked after, being in excellent condition, which shows she must have been a good engine from the start. Mr. Ashworth is now building a locomotive of the *Duchess* class to the same scale, and this, to judge from the chassis, will be a grand job, too.

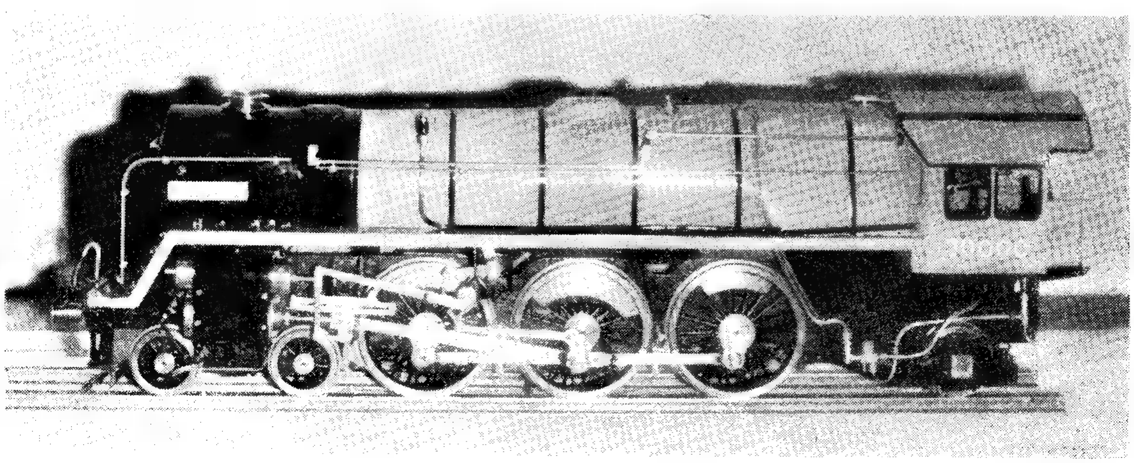
A " Royal Scot " Chassis

Another *Royal Scot* is being built by A. Hutchinson of the home club, but up to now this has only reached the chassis stage. This also looks like becoming a fine engine, despite the fact that Mr. Hutchinson told me that " all sorts of old junk " had gone into the making; many of the parts are fabricated. The builder made his own cylinder patterns and obtained castings at a local foundry, but purchased commercial castings for the wheels and frame stay.

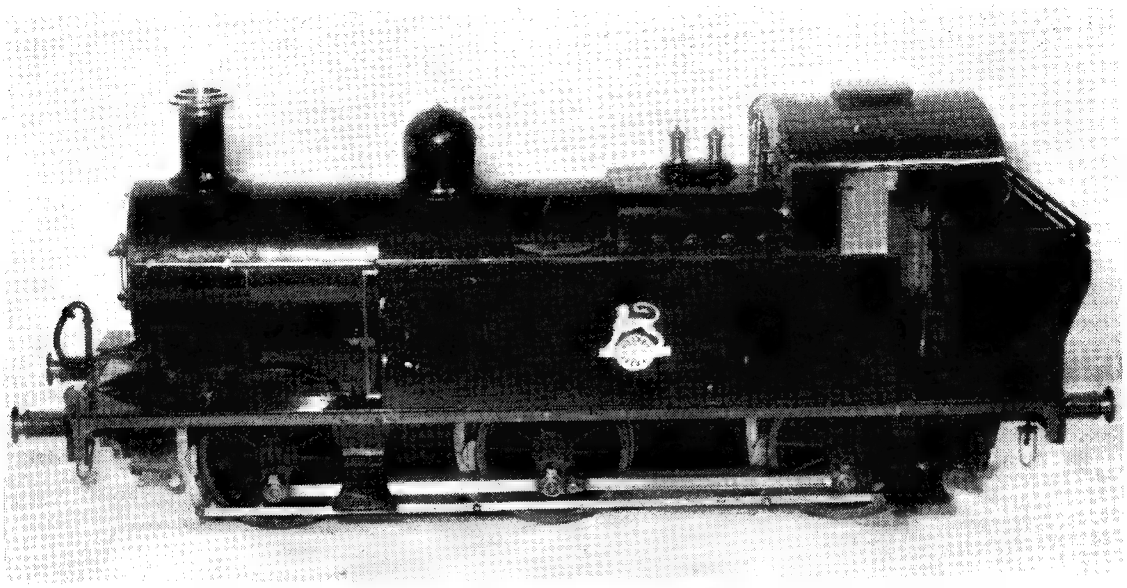
It isn't often one comes across a coal-fired " O "-gauge locomotive, but F. Cann built one as long ago as 1934. This was a free-lance Atlantic, with bogie tender, and a large firebox, which, however, did not spoil the proportions of the engine.

The finish was very good, the machining being really excellent. It would be interesting to know what performance this engine is able to put up.

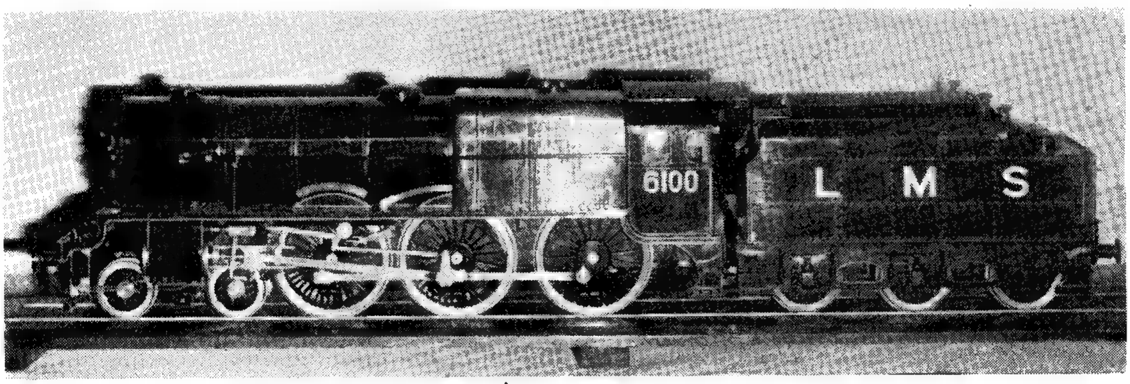
Continued from page 737, December 24, 1953.



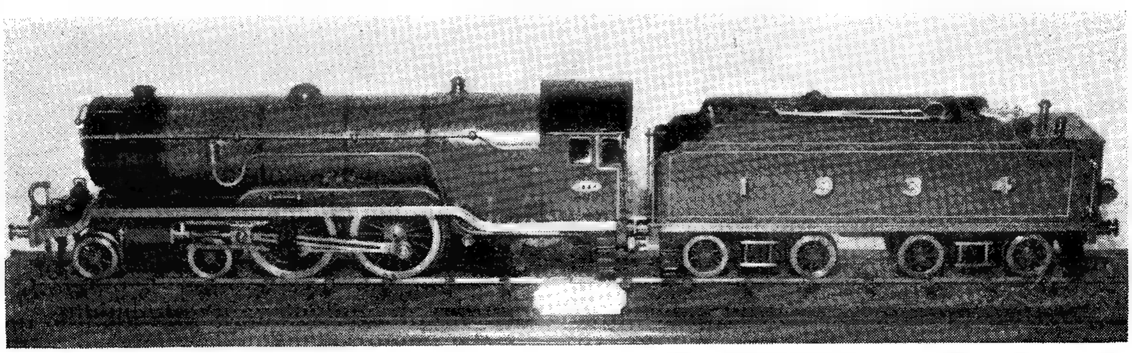
A fine model of " Britannia," built by H. Booth of Bingley as the result of a challenge !



This $3\frac{1}{2}$-in. gauge 0-6-0 *L.M.S. tank engine was built by H. Wood of Bradford*



The President's locomotive—a Royal Scot, built by W. Ashworth to $\frac{3}{4}$-in. scale



Coal-firing in "O"-gauge; an Atlantic built by F. Cann of Leeds

L.B.S.C.'s Lobby Chat

● INEXPERIENCE ALSO TEACHES—BUT IS EXPENSIVE

THIS week, at their own request, I am devoting part of this lobby chat especially to beginners. I'm often receiving queries on the everlasting topic of how to make a start in locomotive-building, what tools to get, what engine is the most suitable for a beginner's first attempt and so on. Now, to keep up my reputation for being unconventional in all things, I'll start by giving an actual illustration of what NOT to do; and it's a rather moving story, at that.

It so happened that a disabled ex-serviceman was in hospital with leg injuries. He was unable to stand, let alone walk, and the "human engineers" were trying to see if the use of his legs could be brought back by aid of various surgical appliances and processes. In the next bed to him, was an old engine-driver who was dying from an incurable disease, and knew it; yet in the goodness of his heart, he felt sorry for the disabled one, and tried to cheer him up with tales of the railway, telling about the various kinds of locomotives he had driven, their various peculiarities, good features, how they steamed and pulled, and what-have-you. The disabled one listened intently, and began to regard railway engines in a somewhat different light to that of the average layman, whose acquaintance with them is just casual. He became a locomotive enthusiast.

In due course, the unfortunate driver passed to the Land Beyond the Veil, much to the sorrow of his bedside friend; but his memory remained, and so did all the information he had so cheerfully passed on. When the disabled one eventually left the hospital, still, alas ! unable to walk, he made the acquaintance of this journal, and started to read it regularly. His newly-awakened interest in locomotives naturally caused him to follow my notes, and he became bitten with the urge to build one, if he could do it sitting down. He decided that it would be possible, and determined to have a go; but was faced with the problems of getting some equipment, and finding out what sort of engine was within his capabilities as a first attempt. His small pension didn't allow of any lavish expenditure, as you may guess, so he cast around for the cheapest equipment that was going. The first item he decided to purchase was a lathe, and here it was that he made his first mistake. Seeing in our advertisements, a small lathe at a reasonable price, he got in touch with the makers, and asked if the machine would be suitable for locomotive-building. He was assured that it was; so he paid his deposit, not being able to purchase for cash, and took delivery of the machine.

The next item was to obtain a motor to drive it; the makers recommended a $\frac{1}{4}$-h.p. motor running at 1,450 r.p.m. He looked up the current prices (that was quite unintentional !), but found them beyond his resources; then it so happened that he saw another advertisement offering $\frac{1}{8}$-h.p. motors at a very cheap rate. As these were stated to run at 3,000 r.p.m. he concluded that they would be equal to a $\frac{1}{4}$-h.p. motor running at half the speed, and bought one. That was error No. 2. A kindly relative undertook to make a bench for the lathe; and then came the "rude awakening"—he wrote to me via the "M.E." offices, and inquired what $2\frac{1}{2}$-in. gauge locomotive I would recommend him to make a start on, telling me about the lathe and motor that he had bought, and saying that he would be getting more equipment as finances allowed.

An Awful Shock

Naturally, I didn't know the full circumstances of the case at the time, otherwise I'd have "softened the blow"; and I replied that the lathe that he had bought, was practically useless for building a $2\frac{1}{2}$-in. gauge locomotive, being far too small and weak to turn the coupled wheels, for a start. I also told him that his motor was under-powered, ran at far too high a speed, and even if it would run the lathe without burning out under a normal cut, he would need relatively enormous pulleys on his countershaft, to reduce the speed to that required for turning castings in the lathe. I added that if he procured a $\frac{1}{4}$-h.p. slow-speed motor, he might manage to machine up the parts of a Gauge "1" *Dot*, and also gave him some idea of what else he would need in the way of equipment. I also added that if he had written me *before* he had spent any money, I'd have gladly put him wise, and saved him from wasting it.

Back came a pretty heartbroken letter, telling me all the facts mentioned in the first paragraphs; and those few good folk who know your humble servant personally, won't need telling that it made me feel very sad. I'm afraid that my estimate of the people who told him that the baby lathe was suitable for locomotive building, would set this paper alight if I put it down ! The misunderstanding about the speed and power of the motor was, of course, entirely his own; but that didn't alter the fact that he had wasted his precious money. He said that he was sadly disappointed; but the only thing he could do, was first to get the lathe paid off, and then see if he could manage to buy a $\frac{1}{4}$-h.p. motor, and some tools, and following my advice, try to build the *Dot*.

"Joy in the Camp"

That night, having finished my weekly penance at the drawing-board and typewriter, I tried to do a bit in my workshop; but I couldn't get on for toffee-apples. Somehow the vision of that poor disabled and disappointed merchant kept bobbing up, and at last I decided that I'd just *have* to do something about it, if only for thanksgiving for sundry kindnesses shown to me, in days gone by. Then I remembered something. I believe that I once told the story of the miner who got coal-dust in his lungs, and couldn't work in the pits any more, so I helped him to start a little business. When the complaint got him in the end, he left me his possessions, in return for "services rendered"; something else

that nearly broke my heart. Among them was a Gauge "1" American-type 4-6-2 which the miner had built to the first serial I ever ran in these notes. She had run until needing overhaul, and then the miner decided to rebuild her to British outline. I had no use for it, so I thought it might amuse our unfortunate brother, to carry on with the job, until he had acquired enough equipment to build a locomotive of his own, right "from scratch." Having the engine with the working parts all assembled and erected, and the boiler on, would give him a good insight into the general construction, action of valve-gear, and so on.

I sent him a note saying that I was going to give him another shock, but one a little more pleasant, and told him to look out for the engine. In due course it was delivered at his door; and almost by return I received a letter, as joyful as the other had been miserable. After profuse thanks, he said that he reckoned it was "all wrong" to alter a Curly design, so he was going to do his best to restore the engine to its original American outline, and would try to obtain back numbers of this journal containing the instructions, so that he wouldn't go wrong. His letter made me feel cheerful, too, so I had a "sort out" and found the remainder of the miner's tools, which I sent on to him, to help matters along; and I am sure that the miner would have wished nothing better than to have been the means of helping a brother in misfortune. Fate plays her cards in curious fashion!

Incidentally, our disabled friend says that he would dearly love to correspond with some overseas beginner at locomotive building; if there is one such, who would care to have a British pen-pal, I would be glad to put him in touch, if he writes to me first.

Driver "Joy Emett"—all set for Hogsnorton, Titfield and Little Twittering!

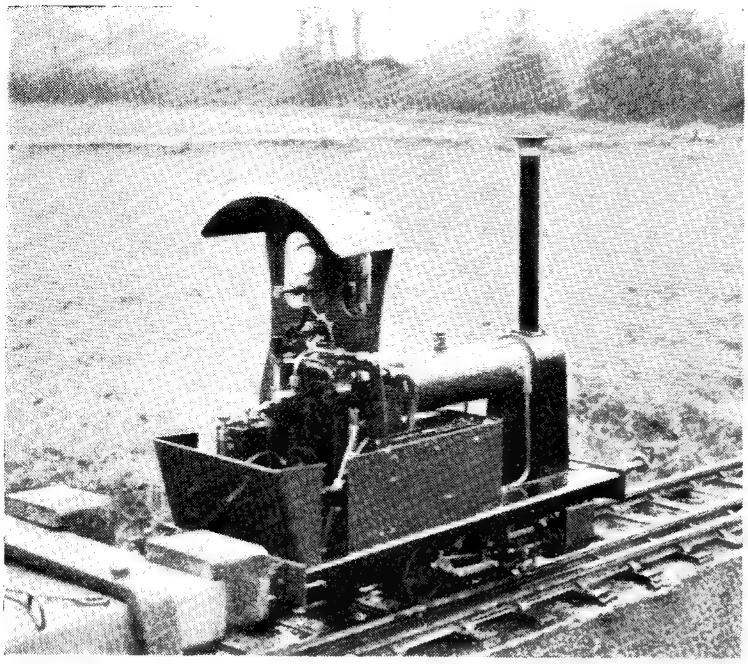
The Whys and Wherefores

My reason for relating the above true story, is of a twofold nature; firstly, a warning of the folly, even though inadvertent, of buying an unsuitable lathe, because it happens to be cheap. Secondly, a protest against makers and vendors of small cheap lathes, asserting that they are capable of work for which they are unsuited, or not powerful enough. This also may be unintentional, and inadvertent, as the said makers and vendors, in all probability, don't realise the nature of the work that the lathe would have to do, in machining up all the castings for a given size of locomotive. A beginner who is a raw recruit should never hesitate to ask what sort of a lathe, and other equipment, would be needed, not only for the engine he intends to start on, but *for any that he eventually wants to build.* I'll explain the reason for that, a little farther on.

As to the second part, if anybody buys a "baby" lathe on the strength of the makers' or sellers' recommendations, and then finds it won't carry out the work, they not only drop 100 per cent. in the buyer's estimation, but lose both reputation and sales in the bargain; for it is a million dollars to a pinch of snuff, that the buyer will broadcast his disappointment to all his friends and acquaintances. Now I wish it to be distinctly understood, that I'm not saying anything against the particular make of lathe that was acquired by our disabled friend as mentioned above. As a lathe, it is very well made, reasonably accurate, and good value for the price asked, as prices rule nowadays; the fault is, that it just "isn't man enough" to do the job for which he required it.

One of my own lathes is a 3-in. (or to be more accurate, a 75-mm.) precision machine, made by the Boley and Leinen firm; a lovely job, with a 2-ft. bed of the vee- and flat-type. It has a compound slide-rest with micrometer collars, four chucks from $2\frac{1}{2}$ in. to 4 in. diameter, the last-mentioned being a four-jaw independent Burnerd; "L.B.S.C. uses these and likes them," truly announced a Burnerd advertisement. It has two separate tailstocks, one with a screw feed, and the other with a lever, to which I fitted a sliding gauge for measuring the depth that a drill penetrates; the headstock, and the lever tailstock, are fitted with draw-in spindles, and collets up to $\frac{5}{16}$ in. capacity. There are other accessories. I bought it new, some 23 years ago, for £28 complete, so goodness only knows what the price would be today. *Now that lathe would be utterly useless for turning the wheels of a $2\frac{1}{2}$-in. gauge locomotive.* It is absolutely the cat's whiskers for making small fittings of all kinds, injectors, small screws, finish-turning pistons and piston-valves to extreme limits of accuracy, and various other jobs connected with locomotive-building; but being single-geared, and running at a high speed, it wouldn't look at an iron wheel casting.

When I fitted the chucks, I machined up the backplate castings on my Milnes lathe; and for finishing them, I made a dummy mandrel nose, similar to that on the Boley, and fitted it in the taper hole in the big Milnes mandrel. On this, the



Mr. B. Hughes's "Emetich"

backplates were truly faced, and the spigots which enter the recesses in the chucks, turned to within about 0.002 in. of required diameter; the backplates were then screwed on to the Boley mandrel nose, and the final scrape taken off the spigot until it fitted exactly. It would have been next to impossible to machine the iron castings on the Boley itself. Even if I had fitted a temporary handle on the end of the mandrel, and turned it slowly by hand, to get the required slow speed, it is probable that the stress of the tool cutting into the hard cast-iron, would have seriously impaired, or possibly have destroyed, the accuracy of the machine You can give maybe £25,000 for a Derby winner—put him to the job of pulling a heavily-laden farm cart over a rough cart-track, and see what happens to his shapely legs; I guess his racing days would be over!

Tools for the Job

I couldn't honestly recommend a lathe smaller than 3-in. centres, strongly built, and back-geared at that, for turning the cast-iron wheels of a 2½-in. gauge locomotive, and machining up the cylinder castings and other parts. Using ordinary high-speed-steel tools, a 3¼-in. or 3½-in. wheel casting, shouldn't turn more than about 60 r.p.m. when the treads are being turned; and to get that slow speed on a lathe driven by a motor running at the usual speed of 1,450 r.p.m., outsizes in pulleys would be needed if there is no back-gear. That worthy old favourite the 4-in. round-bed Drummond, it is true, had no back-gear, and cast-iron wheels could readily be machined on it; but then the pulleys were large, and in the days when it was in vogue, most of the home-workshop lathes were foot-operated. With a small pulley on the pedal flywheel, the slow speed was easily obtained; in fact, pedalling was too much of an exertion, for anybody to exceed the speed limit! Well I know that, from actual experience, as I had no power in my firstfloor back-room workshop at my old home at Norbury, where I built locomotives for sixteen years.

It's all very fine for folk to talk glibly about the advantages of tungsten-carbide tools, but how many home workers have them? I have some, but scores of my correspondents say that they can't afford them; many, in fact, are still using carbon-steel. I use my Wimet and other similar tools, at usual speeds, for I find that despite all assertions to the contrary, the edges will chip and crack if light cuts are taken off scaly castings at a high speed. Then the user has had it, if he hasn't a special grinding wheel, as the ordinary emery or carborundum wheel won't touch them. My correspondence has told many a tale of woe, and I've ground up these "super" tools, for a few personal friends, on my own special wheel.

Look Ahead!

When a beginner decides to buy a lathe, he should, wherever it is possible, look ahead (all good engine-drivers look out for distant signals!) and get a machine which will not only be suitable for the immediate job, but prove a good "long-term speculation." I did just that when I bought my type R Milnes way back in 1923; and now, 30 years after, it still does all I need. During the past year, I fitted to it what is most probably the heftiest chuck ever fitted to a lathe of similar size, viz: a 7½-in. Burnerd geared scroll three-jaw. This wee bit of watchwork weighs 32 lb. The lathe turned up the Bill-Massive-size backplate with all the ease imaginable, and cut the thread for the precision-type mandrel nose. Incidentally, I had to fit the backplate what the kiddies would call "inside-out," with the boss in the hole in the middle of the chuck, so that the back of the chuck is flush with the shoulder of the mandrel nose, and the jaws can open into the gap; the lathe being 3¾-in. centres, the chuck body comes right down level with the bed. The 2¼-in. front mandrel bearing of the Milnes, carries the load without the slightest trouble, and I don't know of any other lathe of similar capacity that would carry a chuck anything near that size and weight. I hope its first locomotive job will be to hold the driving-wheel castings of the old-time G.W.R. ten-footer *Ajax*, which I hope to build "on the quick" for experimental purposes.

Where cost is a ruling factor, as it usually is, a beginner would be well advised to get a hefty used lathe of good make, in preference to a small flimsy new one. No matter if it has worn a bit, because bearings can always be renewed, and the lathe reconditioned practically as new. It is by far the better value than a small new one at similar cost. Remember that a small job can always be done on a big machine, but not vice-versa. An elephant can pull a wheelbarrow, but it would puzzle a mouse to do the same job; nuff sed!

One argument frequently raised is, that a big lathe won't run fast enough for small work; but that doesn't always apply. Just recently, time of writing, "Bro. Reevesco"

and the Managing Director of the Myford Engineering Co., Mr. Moore, paid me a visit. "Bro. Myford" brought some drawings and specifications of their latest Myford Super-Seven for my inspection. It has fourteen spindle speeds, from 2,150 to 25 r.p.m., and should, therefore, be able to do any job, from putting a 78 drill through an injector delivery cone, to turning a *Maid of Kent* driving wheel. Anyway, I'm going to try both jobs on one, and will faithfully report results !

Double-ported Piston-valves

A new reader says that he is about to start on a *Doris*; and reading in this journal some time ago, that a similar engine was built with double-ported piston-valves and a double chimney, wondered if I would advise him to do the same, as it was claimed to be an "improvement" The answer is emphatically NO ! If double-ported piston-valves and a double chimney had been of any advantage, I should have specified them in my original instructions, and shown them on the drawings. The valves and ports specified, and the single chimney, will give the highest possible efficiency; nothing can be gained, and much can be lost, by monkeying about with the design.

A Wrong Idea

Some folk apparently got hold of the idea that because a Trick double-ported slide-valve was an advantage, the same would apply to a double-ported piston-valve. That was where they fell out of the cart, due most probably to lack of actual experience in small locomotive building. Many ideas which seem O.K. on paper, prove N.B.G. on the road; I've proved that in plenty. The idea of the Trick valve was to obtain a quick opening with a slide-valve working over the usual slotted port, by providing an extra passage through the valve. It should be obvious that there is a vast difference between a flat slot, and a port, the length of which is practically equal to the circumference of the liner; and the area uncovered by the head or bobbin of the piston-valve, is actually more than the combined effort of the Trick valve. Ergo, as the actor would remark, the extra port is not needed.

The only effect of fitting double-ported piston-valves, is to provide more useless space which has to be filled with steam, and blown to waste twice in each stroke. All the double chimney does, is to provide an additional outlet for the wasted steam They found out ■ dickens of a lot about things like that, on the Rugby testing stand ! If a *Doris* built to the instructions that I gave in these notes, were tested against a similar engine with double-ported piston-valves and a double chimney, it would be found that the first would be by far the more efficient engine.

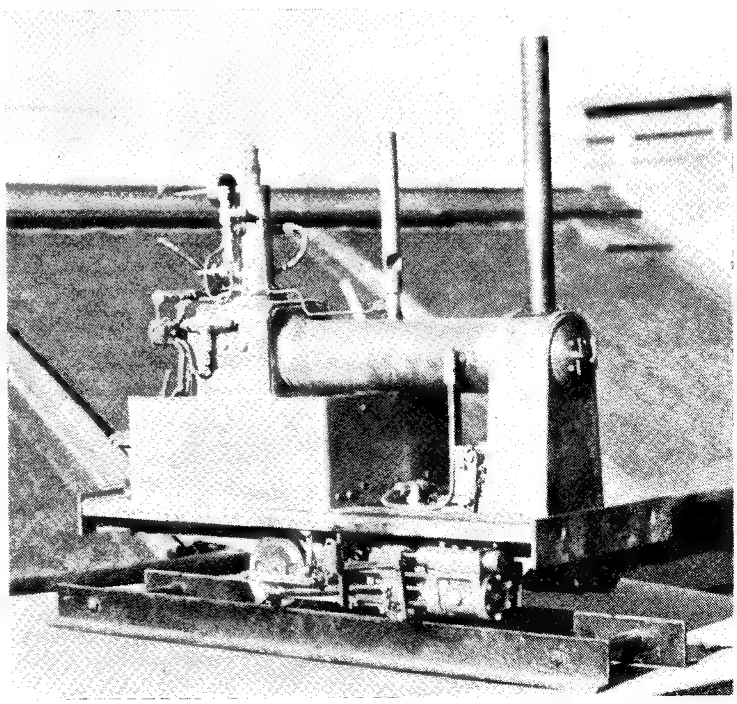
The Latest Variation of Tich !

When I was "evacueeing" at Stafford, during the era of doodle-bugs, a Birmingham schoolboy named Brian Hughes wrote me for information about a locomotive he was proposing to build, and I gave him some friendly advice. That was nine years ago; the schoolboy has now grown up, got a workshop going, and has built his first locomotive. He says in a recent letter, that he wanted to build something entirely different from anybody else, and judging by the reproduced photographs, he has apparently managed it ! She is a *Tich* as far as the working parts are concerned, except that Baker valve-gear has been substituted for the original Walschaerts; the inside of the boiler is also the same as specified for *Tich*, but the barrel is only 2 in. diameter. It is fed by an eccentric-driven pump, and a Kennion injector made to my specifications; there is also an emergency hand pump. This wee boiler was "officially" tested by the Birmingham S.M.E., and just for curiosity, as the boiler was as sound as a bell at 200 lb., the pressure was increased until 300 lb. showed on the club gauge. The boiler never worried a scrap. Bro. Brian says it was because all the plates were properly flanged, and the lot brazed with a Bullfinch gas torch, aided by coke packing.

The boiler steams like a witch, and the little "Emette" has hauled her builder for a mile non-stop on the Birmingham club track at Sheldon. The greatest load shifted so far, has been two adults and two children, on the club car, which itself weighs 65 lb. Congratulations to friend Brian; he certainly put his information to good use !

Tail Lamp

I always enjoy a good-natured leg-pull at my own expense, and the latest is too good to keep. Two readers say that my pen-name is misprinted; it should be L., B.Sc. To get my own back, I suggest that they look up the definition of B.Sc. in the Dictionary of Railroad Esperanto ! !



A mixture of Emett, Tich, and Heath Robinson—but CAN she go !

A Camera Tripod

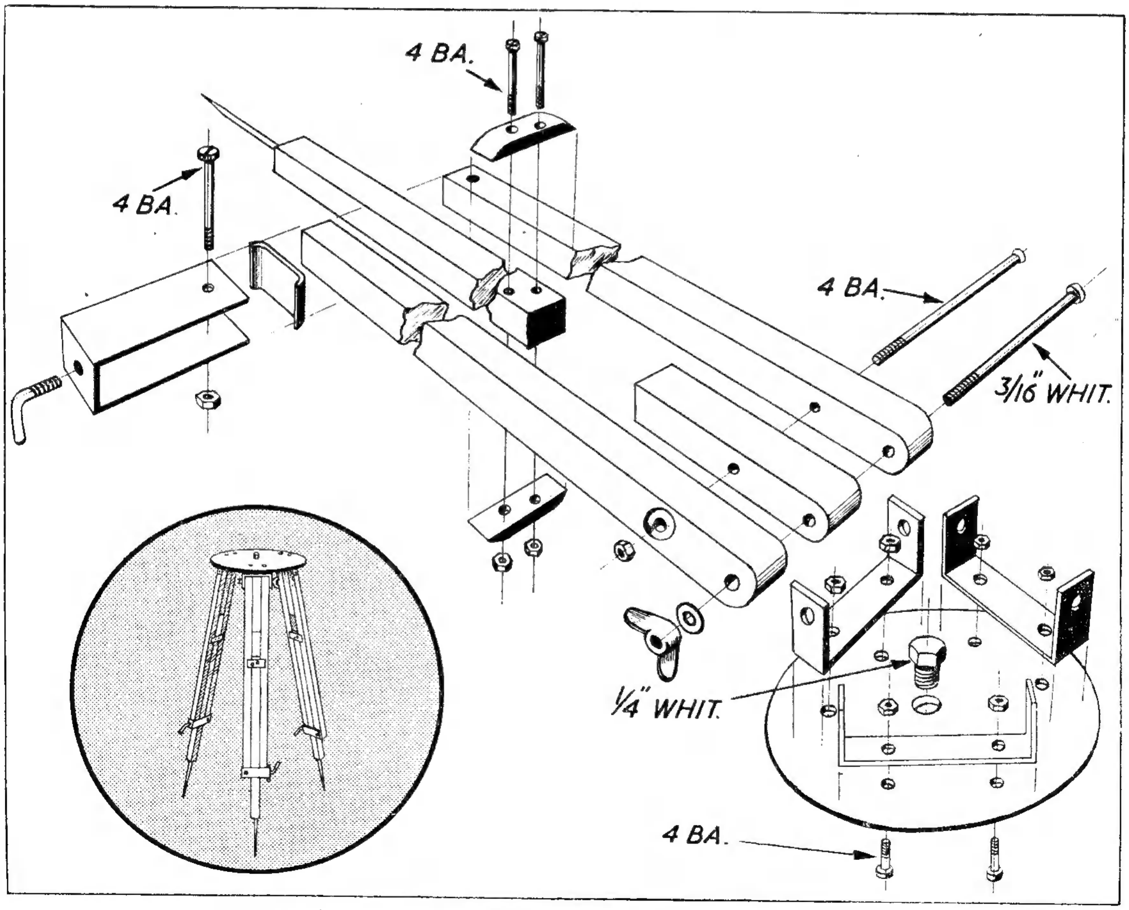
By P. F. Poultney

MANY designs of camera tripods have already appeared in the pages of THE MODEL ENGINEER, but for my use I wanted something simpler than anything that I had seen published. The following describes a tripod that I recently made, which fulfills my own needs and may well meet the requirements of others. It will be seen that each leg consists of a "fixed" part which acts as a guide for the "sliding" part. By means of the clamp at the open end of the fixed part, the slider can be locked in any position, and the brass face-pieces on the slider keep it in line and free of shake.

To make each "fixed" part, bolt together two 18 in. lengths of hardwood, ½ in. square, with a distance-piece 2 in. long of the same material between them flush with one end. At this closed end, drill a $\frac{3}{16}$-in. hole for the bolt on which the leg will swing when attached to the head of the tripod. To make each slider, bolt a piece of brass 1¼ in. × ⅛ in. × ½ in. across two opposite faces at one end of an 18 in. length of the same hardwood. Now make and fit the brass clamp-piece by a 4-B.A. bolt and nut. It will be seen that the depth in the "U" is just over 1½ in., so as to allow a slip of soft metal such as aluminium to be inserted between the clamping-screw and the wood of the leg. This will prevent any damage to the wood by the clamping-bolt. The spikes in the end of each slider were made from brass cupboard hooks screwed in, cut off short and filed to a point.

The head of the tripod is a disc of brass 2½ in. in diameter, ⅛ in. thick. Drill and tap the centre of this for the camera fixing-screw (in my case ¼ in. Whit.). Screw in an appropriate brass bolt and solder in position. Prepare three pieces of brass to the shape and dimensions shown and bolt or solder them to the underside of the disc. Each complete leg can now be fitted in these brass pieces by means of a $\frac{3}{16}$-in. bolt and wing-nut.

Sandpaper down the woodwork and coat with linseed oil or French polish. The brass parts can be polished and coated with transparent cellulose varnish or painted black as desired.



Details, and sketch of the finished simple camera tripod

READERS' LETTERS

● Letters of general interest on all subjects relating to model engineering are welcomed. A nom-de-plume may be used if desired, but the name and address of the sender must accompany the letter. The Managing Editor does not accept responsibility for the views expressed by correspondents.

A SMALL DONKEY PUMP

DEAR SIR,—It is not often that I find myself in disagreement with the "Words and Music" as set forth by your very able contributor "L.B.S.C.", but I feel compelled to point out that his statement in "Lobby Chat," MODEL ENGINEER, November 5th, regarding small donkey pumps is contrary to my experience.

I have made a small Weir-type donkey pump which, under steam, not only works at 12 strokes per min., but slower; indeed, it will go so slowly that it is difficult to detect any movement at all until the shuttle throws. Fellow-members of the Eastbourne Society of Model Engineers can easily testify to this fact. The bore and stroke of the steam cylinder of this pump are $\frac{5}{8}$ in. and the overall height is $3\frac{3}{8}$ in. The cylinder is made from a solid block of bronze and is not lagged, As can be seen from the photograph (taken by H. C. Deal of Eastbourne), the pump is fitted to a $3\frac{1}{2}$-in. gauge *P. V. Baker*, which has, by the way, proved a very successful engine; but that is another story.

Yours faithfully,

Eastborne L. A. BURVILLE.

CIRCULAR SAWS

DEAR SIR,—May I venture into the realm of controversy through your columns (for the first time in the field of model engineering, at any rate) and add something of my own experience regarding the building and use of an 8-in. circular saw.

Your correspondent, C. Gaunt, is critical of the advice tendered to F.T. of September 10th, regarding the peripheral speed that should be obtained for correct cutting speed, gives us some examples of what he contends is his own experience, and tells us that, in effect his saw spindle speed is something in the region of 1,675 r.p.m. and that he has got results by cutting his own type of tooth, which he illustrates.

Whilst I hesitate to say that Mr. Gaunt is wrong, I do, very sincerely, doubt that the figures that he quotes regarding the spindle speed will give him the highly ideal results which he infers, despite his experience, but, with all respect, trust that he will not jump on his charger and belabour me with invective for so doubting, as does W. J. Hughes in the same issue in regard to some sceptic who questioned his mathematics and scale proportions.

Some six months ago I built from plans, an 8-in. circular saw, and after a period of experiment, first with a B. & D. special $\frac{1}{4}$-in. drill as motive power, with a 4-in. and then 6-in. cross cut tooth saws, I ventured into the field of big saws and purchased a 1/3rd h.p. motor, as originally advised, and an 8-in. cross cut toothed saw to match. Incidentally, my saw has a rise and fall table, instead of a rise and fall spindle, which works very well indeed, and after a period of frustration in attempting to get big saw results, I referred to the saw makers for the correct speed, which was given as 4,500 r.p.m. for an 8-in. saw or slightly better than a 3 to 1 ratio between motor and spindle, at motor speed 1,450. I contented myself with the straight 3 to 1 increase by a 6-in. motor pulley and 2-in. spindle, this small size enabling me to get over $2\frac{1}{2}$ in. of saw above the bench top, and which for a short time did yeoman service, and enabled me to recover quite a quantity of timber (after a careful search for nails, etc.), and then, it jibbed, and nothing that I did would improve the performance. So, after

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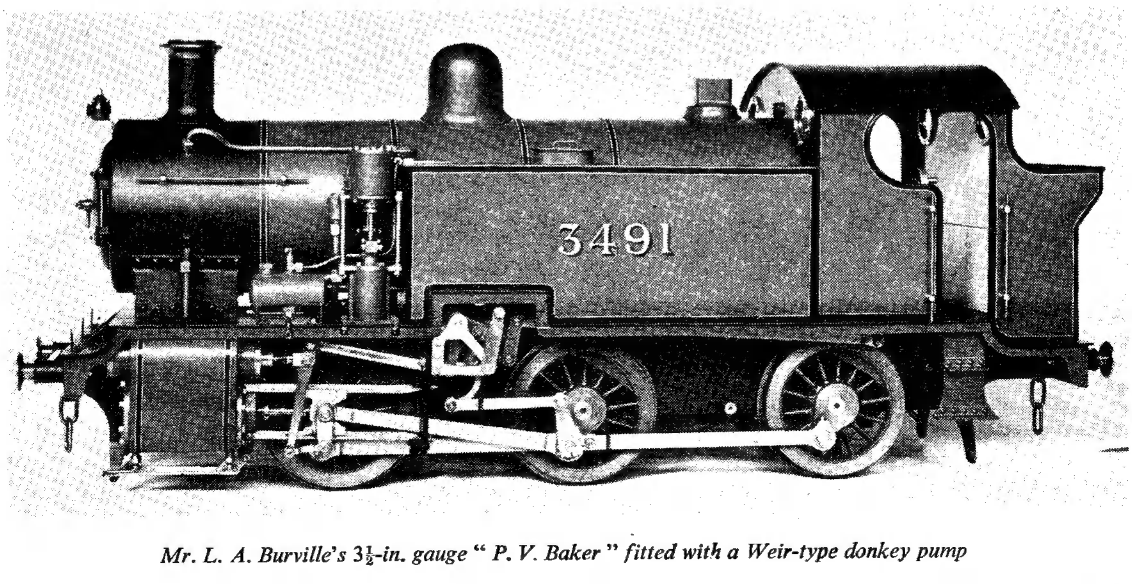


Mr. L. A. Burville's $3\frac{1}{2}$-in. gauge "P. V. Baker" fitted with a Weir-type donkey pump

QUERIES AND REPLIES

" THE M.E." FREE ADVICE SERVICE. Queries from readers on matters connected with model engineering are replied to by post as promptly as possible. If considered of general interest the query and reply may also be published on this page. The following rules must, however, be complied with:

(1) Queries must be of a practical nature on subjects within the scope of this journal.
(2) Only queries which admit of a reasonably brief reply can be dealt with.
(3) Queries should not be sent under the same cover as any other communication.
(4) Queries involving the buying, selling, or valuation of models or equipment, or hypothetical queries such as examination questions, cannot be answered.
(5) A stamped addressed envelope must accompany each query.
(6) Envelopes must be marked " Query " and be addressed to THE MODEL ENGINEER, 19-20, Noel Street, London, W.1.

Harmonograph

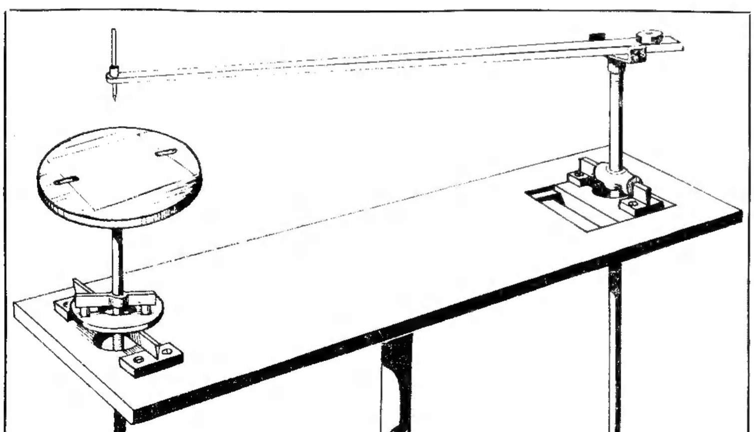
I wish to construct a device which I understand is known as a Harmonograph, and shall be obliged if you could assist me with regard to the design and construction of this piece of apparatus. I made a rough one many years ago to a design described in THE MODEL ENGINEER, *but I cannot remember the ratio of the drive pulleys. It is desired to make this to a high degree of precision for the purpose of accurately engraving designs on brass or copper. Can you advise me of any technical book which describes this device ?*

C.J. (Leicester).

The term Harmonograph has been used to describe various devices for producing harmonic or geometric designs, but it is usually taken to mean a device in which a double or compound pendulum is employed to produce graphs which are the resultant of the swing of the pendulums in various planes.

This type of device is not suitable for the purpose you specify, namely, engraving designs on brass or copper, and the usual device for generating such designs is known as a geometric chuck. We do not think it is practicable to use any form of device which relies on belt drive for the accurate reproduction of geometric designs. A gear-driven device would appear to us to be a necessity.

We do not know of any book at present generally available which describes a suitable piece of apparatus. You may, however, be able to obtain some information on the subject from the Society of Ornamental Turners, Secretary F. J. Howe, 5, Southbourne, Hayes, Bromley, Kent.



Lathe Change Gears

I have recently constructed a $1\frac{3}{4}$ in. plain centre lathe which I wish to convert into a back-geared screw-cutting lathe. I have worked out a train of 8 gears, including two 20-tooth gears, and rising by fives to 50 teeth, which would accommodate all the thread pitches I am likely to require. Can you please advise me how to calculate the diameter of the gears I should require, and also what pitch the gears should be cut ?

R.R.G. (Wolverhampton).

We cannot advise you definitely on the production of gears for a small screw-cutting lathe unless we have some idea as to the convenient diameters of the gears you propose to use.

In view of the fact that the lathe is of $1\frac{3}{4}$ in. centres, however, it would appear that gears of about 32 diametral pitch might be suitable.

To find the pitch diameters of the gears, the number of teeth should divided into the d.p., that is to say, a 20-tooth gear would be 20/32 in. or $\frac{5}{8}$ in. diameter, and a 50-tooth gear would be 50/32 in. or $1\frac{9}{16}$ in. diameter.

This figure gives the diameter on the actual working pitch, and to find the outside diameter of the blanks, two teeth should be added in each case, thus the blank diameter of a 20-tooth gear would be 22/32 in. $= \frac{11}{16}$ in. and of a 50-tooth blank would be 52/32 in. $= \frac{5}{8}$ in.

Globe Valves

" L.B.S.C." recently mentioned globe valve body castings, which surprised certain of your approved advertisers. Can you please inform me if such castings are available, and from whom ?

A.E.C. (London, E.6.)

Globe valves of the kind referred to can be obtained from Bassett-Lowke Ltd., Bonds o'Euston Road, Kennion Bros. (Hertford) Ltd., and possibly A. J. Reeves & Co. of Birmingham.

Dynamo for Workshop Lighting

I have a 12-volt 750-watt aero dynamo which I wish to use for direct lighting of my workshop. Please advise me whether it is necessary to include a voltmeter and ammeter in the circuit, and how many lamps can be put in circuit at one time ? I propose to drive the dynamo with a $2\frac{1}{2}$ h.p. petrol engine.

E.F. (Gillingham).

A voltmeter and ammeter in the circuit of a dynamo for the purpose of workshop lighting are desirable conveniences, but are not absolutely necessary.

If the dynamo has some form of automatic voltage control incorporated in it, or if the engine which drives it is governed, it is quite suitable for direct lighting without the use of an accumulator in the circuit, but the latter has the advan-

tage of enabling the lamps to be used at times when it is not convenient to start up the dynamo.

The number of lamps which can be put in circuit at one time will depend on the wattage of the lamps. For instance, if 12-volt 30-watt lamps are used, 25 of these could be connected in parallel to absorb the full 750 watts which the dynamo is capable of delivering. We would, however, point out that dynamos designed for aircraft work are, generally speaking, unsuitable for running at full load on continuous duty, and it is, therefore, desirable to limit the output to a lower wattage than that specified.

Low Pressure Blower

I propose to use an ex-Government vane-type blower or compressor to give a supply of air to a small forge, and also a coal-gas blow torch. Would this be satisfactory? What volume of air per minute and pressure would be required in each case?

W.M.R. (Belfast).

An ex-Government vane-type blower should be quite satisfactory to supply air to a small forge or a coal-gas blow torch. We cannot, however, advise you what volume of air per minute would be required in either case, as this will depend on the size of the air nozzle.

It is possible to control the output of the blower to some extent by using a multi-step pulley for the drive, and we have very little doubt that you will be able to accommodate it to your requirements at speeds varying from about 700-1,500. A pressure of about 5 lb. per sq. in. will be ample for either of the specified purposes.

Recess Forming

Can you please inform me what process is adopted for forming square or hexagonal recesses in socket set-screws, chuck jaw screws, box spanners, etc., which are made from solid material?

G.D.F. (Galway).

Various methods are adopted in forming square or hexagonal recesses; we do not know the exact method adopted in the case of socket-head screws, though we have reason to believe that it may be done by hot forging.

In many cases, however, work of this nature is done by a cold process in which a solid cutting tool of the required shape is forced into a round hole by means of a heavy press. This operation can be facilitated if it is possible to chamber out the recess at the bottom of the blind hole to clear the chips produced by the cutting tool.

Other methods employed include swaging, that is to say, rolling down the outside of the work on to a hardened mandrel of the required shape, or by a slotting operation in which one corner only is dealt with at a time.

Motor Control Resistance

I have a sliding resistance which I wish to rewind to control a 1/10 h.p. Mains Universal motor. Could you please tell me what length and gauge of wire to use. The former is rectangular, $1\frac{1}{2}$-in. × $\frac{3}{4}$-in. section, and $3\frac{1}{2}$-in. of its length is available for winding.

W.L. (London, S.W.1.)

We are extremely doubtful whether you will be able to get a really adequate amount of resistance wire in the space available on the former. We assume that a resistance of approximately 650 ohms would be necessary to get a full range of control on this motor at all loads. The wire should be not less than 32-gauge (0.0108 in. diameter) in order to carry the maximum current adequately without undue heating. A suitable resistance wire would be Eureka, and a length of about 80 yards would be required.

Allowing $4\frac{1}{2}$ in. per turn, and 50 turns per inch, so as to give a slight air space between each turn, this would occupy $10\frac{1}{2}$-in. of the former.

It may be possible to use a somewhat smaller gauge of wire and work at a higher temperature, but in that case it is possible that the heat would cause the wire to sag, and give trouble with the sliding contact of the resistance.

READERS' LETTERS

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further study of what I thought might help, I obtained a further blade with teeth in the form that friend Gaunt commends, which for a brief period gave something like the original performance; then, even that blade wouldn't get through the work, and the job went on the blink.

Greatly daring, at this stage, for electricity is not my best subject, because of the terriffic heating being generated by the motor under work, I dismantled the motor, and like the old lady who found the mouse in the clock, I found that the engine driver was dying; in other words, I had worked the motor so hard that the heat had melted the solder which had the mysterious coils sweated inside, which was explained to me in technical terms, but to which heights I find I cannot rise; however, away went the 1/3 horse to be reshod.

All this verbiage must, however, teach us something, and the one thing that sticks out a mile, is, that the fault lies not so much in the saw type, or the motor, but in the proud builder who says to his friends and neighbours: "Oh, aye! it'll saw 4-in. timber, like cheese! Solid oak too!!" (or pitch pine, or what have you), and proceeds then to try and saw 6-in. timber, and belabours his machine until something bust's, and then blames the saw!

No! Keep as reasonably close to the maker's speeds, but do, above all, remember that it is only a "pup," and is not meant to do other than lightwork. The type of saw should fill all that F.T. (Croydon) wants if he uses the right blade, and his "loaf." I have now obtained one of the "fancy" toothed blades, one big deep tooth, and three small ones, which is recommended for ply-wood, and which, now that the 1/3rd has new shoes on, appears to be doing the best job yet, and certainly gives the best finish up-to-date.

Having in the interim period acquired that desire of most "modellers," a lathe, my saw now boasts a sealed ball-race bearing after the style of "Duplex" internal grinding spindle, which I think has added something to the performance.

As this epistle started as a criticism of Mr. Gaunt, perhaps I should get back to the point, by saying that, as regards the cross-cut type of tooth, these saws will run successfully at a slower speed, which I have proved in slotting and rebating, but the rip-type, no! At a slower speed they jam, and at anything appreciably higher in speed they burn and lose temper. That has been my experience over the past 7 months, and I am now resolved to keep the work down to the strength of the saw, and the motor! Incidentally, if F.T. cares to write to me direct, or through your good offices, I shall be glad to exchange experiences with him.

Yours faithfully,

Bolton. WM. HOLLAND.